

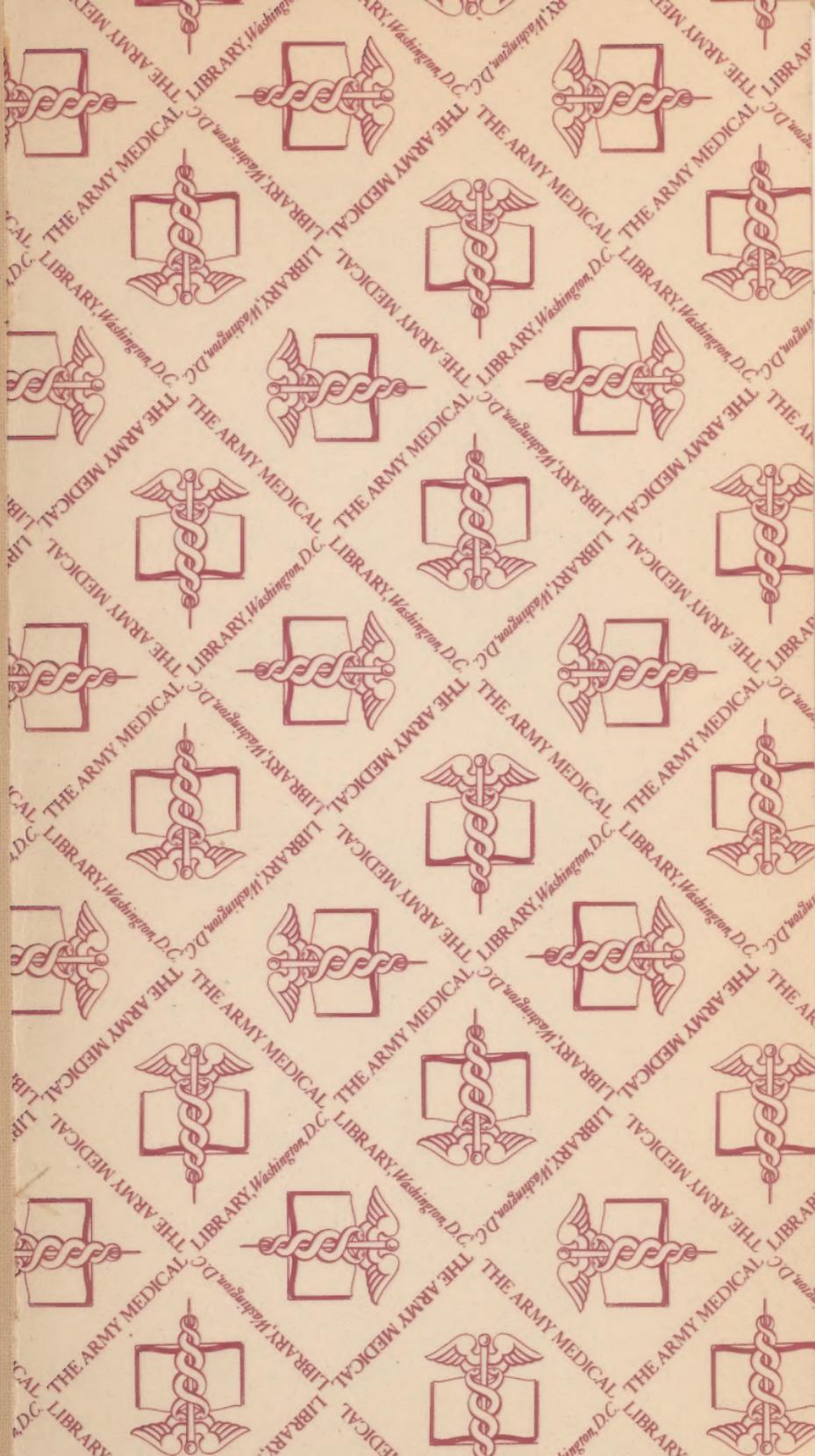
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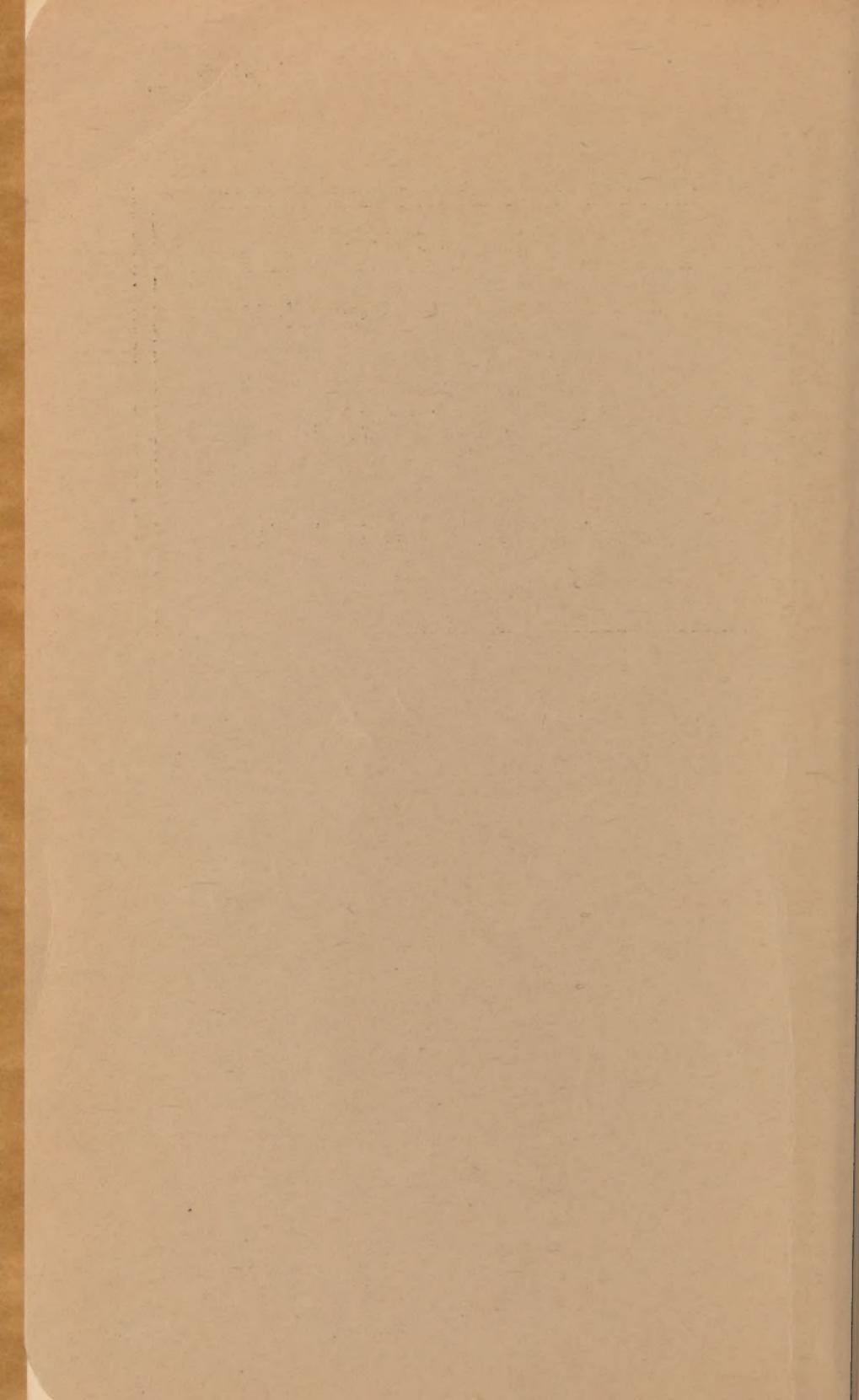


U.S. WAR DEPT. FIELD MANUAL.

CHEMICAL WARFARE SERVICE, SUPPLY AND FIELD  
SERVICE. FM 3-15.







U.S. War Dept.  
" Field manual FM 3-15

# CHEMICAL WARFARE SERVICE FIELD MANUAL



## SUPPLY AND FIELD SERVICE

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Prepared under direction of the  
Chief of the Chemical Warfare Service



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# CHEMICAL WARFARE SERVICE FIELD MANUAL

## SUPPLY AND FIELD SERVICE

### CHAPTER 1

#### GENERAL SYSTEM OF SUPPLY IN THE FIELD

	Paragraphs
Section I. Geographical organization for war-----	1-5
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### SECTION I

#### GEOGRAPHICAL ORGANIZATION FOR WAR

- 1. THEATER OF WAR.—When war exists, the area directly involved is known as the theater of war. That part of the theater of war which a nation controls is divided into a zone of the interior and one or more theaters of operations.
- 2. ZONE OF INTERIOR.—The zone of the interior is organized to furnish man power and munitions of war for the armed forces, and comprises that national territory not included in the theater of operations.
- 3. THEATER OF OPERATIONS.—*a.* A theater of operations comprises the areas of land and sea it is desired to invade or defend including that which is necessary for administrative establishments and agencies pertaining to the forces in the theater. Its area is delimited by the War Department. There may be one, two, or several theaters of operations. Each theater is divided for the purposes of combat and for decentralization of administration into a communications zone and a combat zone.  
*b.* Until an advance is made, a theater of operations may include only a combat zone, installations and facilities of the zone of the interior being utilized for the time being for the service of combat forces.

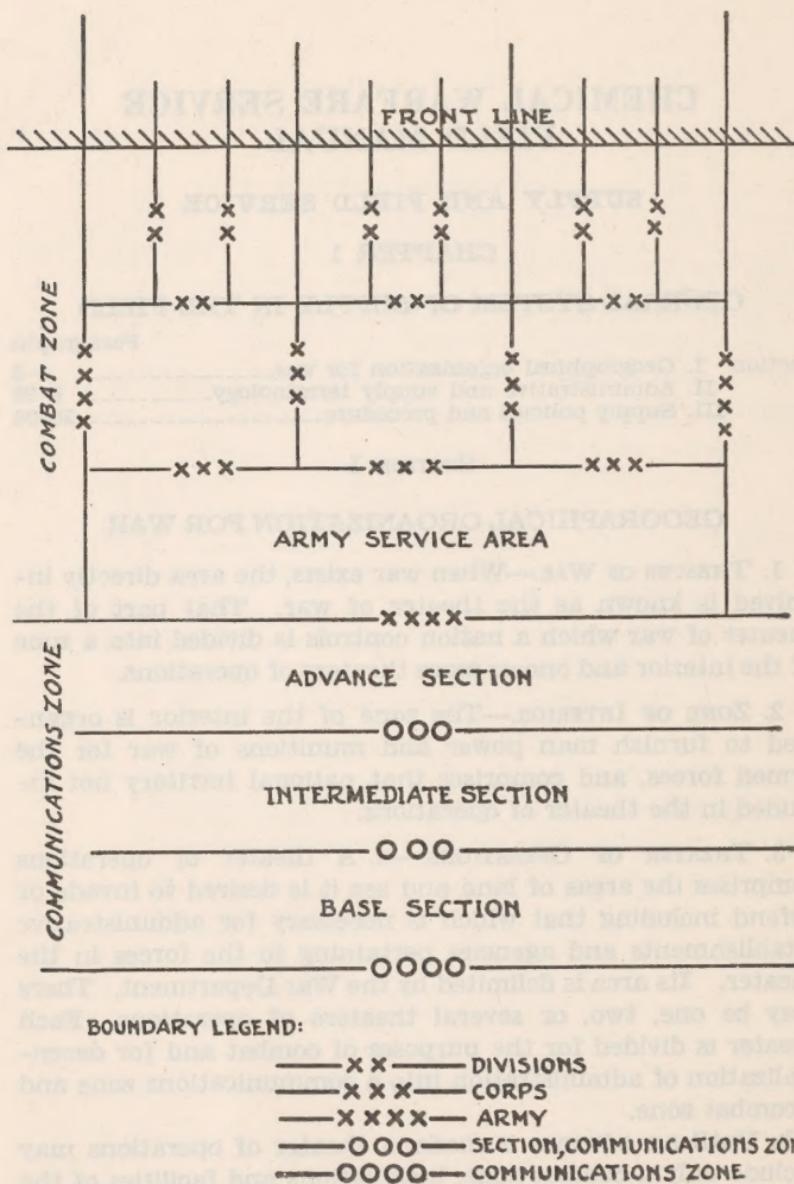


FIGURE 1.—Typical organization of a theater of operations

c. Chiefs of supply arms and services at headquarters of a theater of operations, who exercise general technical direction of their services as a whole, are responsible to the theater commander for the efficient operation of their services, and command the troops and installations of their services which are not assigned or attached to subordinate units.

■ 4. COMMUNICATIONS ZONE.—*a.* The communications zone, when established, comprises the rear portion of the theater of operations. It contains the principal establishments of supply and evacuation, lines of communication, and other agencies required for the continuous service of the forces in the theater of operations.

*b.* In some situations the communications zone may become so extended in depth as to make it desirable to divide the zone into a base section and an advance section, in order to secure centralized control and decentralized operation. In exceptional cases, usually in connection with oversea operations, it may become desirable to divide the communications zone into three sections, designated in order from rear to front as base, intermediate, and advance. Unusual conditions may require a subdivision of the sections of the communications zone into subsections. (See FM 100-10.)

■ 5. COMBAT ZONE.—The combat zone comprises the forward portion of the theater of operations. It is divided into army areas, the forward parts of which are subdivided into corps areas and these in turn into division areas. A service area is established in each army area and each corps area for the purpose of such technical, supply, and administrative service as the subordinate command requires. (See FM 100-10.)

## SECTION II

### ADMINISTRATIVE AND SUPPLY TERMINOLOGY

■ 6. SUPPLIES.—*a. General.*—The term "supplies," in a military sense, covers all things necessary to the equipment, maintenance, and operation of a military command. It includes food, clothing, equipment, arms, ammunition, fuel, forage, construction materials, and machinery.

*b. Classification of supplies.*—For simplicity and convenience of administration, supplies required by troops in the field are divided into five classes (see FM 100-10).

(1) *Class I.*—Supplies which are consumed at an approximately uniform daily rate irrespective of combat operations or terrain, and which do not necessitate special adaptation to meet individual requirements, such as rations and forage. No chemical warfare supplies are included in this classification.

(2) *Class II.*—Supplies which are authorized articles of equipment for which allowances are established by Tables of Basic Allowances, such as clothing, arms, trucks, radio sets, tools, and instruments. Chemical warfare supplies in this class include gas masks, gas alarms, collective protectors, weapons of chemical troops, etc.

(3) *Class III.*—This class includes engine fuels and lubricants, such as gasoline for all vehicles and aircraft, diesel oil, fuel oil, and coal.

(4) *Class IV.*—With the exception of ammunition, this class includes those articles of supply which are not covered in Tables of Basic Allowances and the demands for which are directly related to the operations contemplated or in progress. Chemical warfare items in this class include decontamination materials and disinfectant for gas masks.

(5) *Class V.*—All ammunition, pyrotechnics, antitank mines, and chemicals are included in this class.

*c. Articles of supplies in classes I, II, and III may, by reason of special stringency and the consequent necessity for exercising closer command control over issues, be transferred to class IV, pending the reestablishment of the normal status of supply in those articles.*

*d. Requirements in class I and II supplies are relatively constant from day to day. Requirements in class III supplies are likewise relatively constant when applied to periods of weeks or months. Requirements in class IV and class V supplies, however, vary between wide limits.*

*e. The above classification which applies to military supplies in general should not be confused with the separate classification used within supply arms and services in re-*

gard to the supplies furnished by them. For instance, as shown in the Chemical Warfare Service Supply Catalogue, all chemical warfare supplies are divided in the service classification into classes I to IX, and of these, war chemicals (class II CWS) are further classified in groups A, B, and C.

- 7. PROCUREMENT.—Procurement is the administrative process of acquiring supplies or services. It is effected by manufacture or purchase, requisition, establishment of credits, or a system of automatic supply.
- 8. REQUISITION.—A requisition is an authoritative original request for supplies required.
- 9. CREDIT.—A credit is an allocation of a definite quantity of supplies placed at the disposal of the commander of an organization for a prescribed period of time.
- 10. CALL OR DRAFT.—A call or draft is a demand for the delivery of supplies under the terms of a credit.
- 11. PRIORITIES.—Priorities are definite rulings which establish, in order of time, the precedence of shipments, and the movements of rail, road, water, or other transport.
- 12. RESERVE.—Supplies accumulated in excess of immediate needs for the purpose of insuring continuity of an adequate supply under any condition of campaign are termed "reserve supplies." Reserves accumulated by the army, detached corps, or detached division in the vicinity of the battlefield in addition to unit and individual reserves are termed "battle reserves." "Unit reserves" are prescribed quantities carried as a reserve by organizations. "Individual reserves" are the supplies carried on the soldier, animal, or vehicle for his or its individual use in an emergency.
- 13. BALANCED STOCKS.—Balanced stocks are an accumulation of supplies of all classes and in the quantities determined as necessary to meet requirements for a fixed period of time.
- 14. DAY OF SUPPLY.—The day of supply is the estimated average expenditure of the various items of supply per day, in campaign, expressed in quantities of specific items or in pounds per man per day.

- 15. UNIT OF FIRE.—A unit of fire for a designated organization or weapon is the quantity in rounds or tons of ammunition, bombs, grenades, and pyrotechnics which it may be expected to expend on the average in one day of combat.
- 16. REQUIREMENTS.—Requirements are the computed needs for a military force embracing all supplies necessary for its equipment, maintenance, and operation for a given period. They are classified as individual and unit, and subclassified as initial, maintenance, and reserve.
- 17. AUTOMATIC SUPPLY.—This term signifies a process of supply under which deliveries of specific kinds and quantities of supplies are made in accordance with a predetermined schedule. Daily automatic supply means that certain supplies are dispatched daily to an organization or installation.
- 18. DAILY TELEGRAM.—This is a daily telegram or other message dispatched by a division or higher unit giving the unit's situation as regards to supplies. A strength report is included. The telegram is the basis on which class I supplies to be forwarded are computed.
- 19. DEPOT.—A depot is an organized locality for the reception, classification, storage, issue, or salvage of supplies, or for the reception, classification, and forwarding of replacements. Arm or service depots pertain to a single arm or service and general depots pertain to two or more arms or services.
- 20. DUMP.—A dump is a temporary stockage of supplies established by a corps, division, or smaller unit.
- 21. DISTRIBUTING POINT.—A distributing point is a place other than a depot or railhead at which supplies are issued to regiments or smaller units.
- 22. LINES OF COMMUNICATION.—This includes the network of railways, waterways, and roads which lead into the combat zone from administrative establishments located in the communications zone and the zone of the interior.
- 23. REGULATING STATION.—A regulating station is a traffic control agency established on lines of communication through

which movements are directed and controlled by the commander of the theater of operations.

■ 24. RAILHEAD (TRUCKHEAD, NAVIGATION HEAD).—A supply point where loads are transferred from the particular type of transportation being employed.

■ 25. TRAINS.—*a. Train of unit.*—The train of a unit is that portion of the unit's transportation, including its accompanying personnel, which operates under the immediate orders of the unit commander, in supply, evacuation, and maintenance. It is designated by the name of the unit, such as "1st Chemical Regiment Train."

*b. Daily train.*—The term daily train applies to the train arriving daily at a railhead with class supplies for the troops which the railhead serves. (A daily train may consist of one or more unit sections, each unit section being for a designated division or other unit or group of units of approximately the same number of men as a division.)

### SECTION III

#### SUPPLY POLICIES AND PROCEDURE

■ 26. GENERAL.—*a.* The supply service system must be so organized that it can readily be adapted to constantly and often rapidly changing conditions of military operations.

*b.* The impetus in supply is from the rear, it being the duty of supply agencies to ascertain and anticipate requirements and make provisions accordingly through careful planning.

*c.* Supply is a function of command.

■ 27. REQUIREMENTS.—Supply requirements for the theater of operations are incorporated in plans of the War Department. After operations begin, these are checked by the theater commander and are resubmitted to the War Department for approval. Deliveries to the theater of operations are generally controlled by schedules of priorities.

■ 28. LOCAL PROCUREMENT.—The major portion of the supplies for the theater usually must be obtained from the zone of the interior. However, procurement from local sources is

sought whenever practicable in order to reduce the burden or transportation facilities.

■ 29. ISSUE AND ACCOUNTING.—*a.* Issue of supplies to troops is initiated by a statement of their requirements. They must be furnished their authorized requirements when and where needed and, in an emergency, without the necessity of formal requisition.

*b.* Troops must not be encumbered with a greater quantity of supplies than is necessary to insure their readiness for action. Supplies must be made available to meet the needs of the forces promptly and with safety. This is done by advancing supplies as far as conditions permit and by their distribution in depth and width.

*c.* In the combat zone, no formal accounting for supplies is required, but receipt will be taken for all supplies issued. Strict adherence to formality and insistence on special forms in requisitioning supplies are avoided. Requests for supplies made in any manner by those responsible for filling supply needs of troops engaged in active operations are honored. However, the normal method of requisitioning supplies is used whenever practicable. The responsibility for requisitions, their necessity, sufficiency, and accuracy rests with the regimental or similar commander.

■ 30. DEPOT SYSTEM.—*a.* Flexibility of supply operations is assured through depots echeloned laterally and in depth. The communications zone, when established, is the base of operations of the supply system in the theater of operations. In case the theater of operations, in whole or in part, lies within the continental limits of the United States, a communications zone may not be established. In such case supplies for the theater of operations are furnished from War Department depots.

*b.* (1) The number, location, and character of communications zone depots, the amount of storage space allotted each supply arm or service, and the location of repair and other service installations in the communications zone are determined by the communications zone commander in accordance with policies of the commander of the theater. The forward establishments contain balanced stocks maintained

at such level as necessary to meet promptly the needs of troops in the combat zone. In the rear establishments are received the supplies arriving from the zone of the interior or obtained by local procurement.

(2) General depots are organized in sections, each designated by the name of the particular supply arm or service to which it pertains, for example, ordnance section, chemical warfare section, etc. Each general depot is commanded by an officer designated by the communications zone commander. The general depot commander coordinates the activities of the various section supply offices but usually leaves to them the internal management of their respective sections.

(3) The organization and administration of arm and service depots in the communications zone are direct responsibilities of the chiefs of the supply arms and services. The amount of supplies stored in these depots is prescribed by the commander of the communications zone.

c. The army is the basic supply unit in the combat zone. It establishes depots to insure timely supply of its component division, corps, and army troops. Decision as to the kinds and quantities of supplies maintained is a responsibility of command. In principle, only such stocks of supplies as the military situation demands be kept nearer to the front than communications zone establishments are kept in army depots.

d. The corps as a rule has few supply responsibilities except for corps troops. It is usually concerned with the supply of the divisions only to the extent of assurance that such supply is satisfactory. However, when the corps is operating independently, or for any other reason is charged with responsibility for its supply and evacuation, it operates installations similar in character to those prescribed for the army. In such case, it is necessary that additional service troops are attached to the corps.

■ 31. SUPPLY PROCEDURE.—*a. General.*—From arm or service depots, arsenals, or other procurement establishments in the zone of the interior, supplies are shipped to general or arm or service depots in the communications zone. In the latter depots, stocks are maintained at certain levels determined for

each theater of operations according to estimated requirements. Such stockage requirements vary according to the size of the force, the climatic and geographical conditions of the theater, the distance between the theater of operations and zone of the interior, and the available transportation facilities. Communications zone depots forward supplies through a regulating station to army depots or railheads in the combat zone, where they are obtained by division, corps, or army service trains for delivery to troops.

The transportation of supplies into the combat zone is normally by railroad, hence wherever possible, all major supply installations in both the communications zone and the combat zone should be located at points on railway lines provided with terminal and switching facilities. Transportation forward of army depots or railheads is generally by motor truck, wagon, or pack animal, depending upon the nature of the forces and character of the campaign.

*b. Class I supplies.*—These supplies are usually provided on an automatic basis. Calls for class I supplies are made by means of a daily telegram from divisions or similar units to the army quartermaster, stating their strength in men and animals. The army quartermaster prepares a consolidated daily telegram including provisions for army troops and dispatches it to the regulating officer, who causes the necessary shipments to be made from depots of the communications zone to unit railheads in the combat zone, where the supplies are issued to troops.

*c. Class II supplies.*—(1) This class of supplies usually is made available in the form of credits in designated depots. When credits are established for an army in communications zone depots, calls are made as necessary by the army supply service concerned direct to the proper communications zone depot, or through the corresponding supply officer at the regulating station. In either case, a copy of the call for supplies is sent to the regulating station. Shipments from communications zone depots are made at the instance of the regulating officer through the regulating station to the army depot concerned.

(2) When credits are established in army depots for divisions and corps troops, calls are made as required direct

on the proper army depot by the division or corps supply service concerned. Division and corps transportation is then sent to the depot for the desired supplies. If no credits are established, supply is on a requisition basis. In this case, supply officers submit approved requisitions direct to the proper supply service of the next higher echelon in the chain of supply, where the requisitions are filled from available the main supply routes leading thereto.

*d. Class III supplies.*—Engine fuels and lubricants are supplied in the field on the basis of actual needs. Gasoline and oil supply points are established at all railheads and depots, and at convenient locations such as gasoline filling stations on the main supply routes leading thereto.

*e. Class IV supplies.*—These supplies are provided on a requisition basis in the manner prescribed above for class II supplies.

*f. Class V supplies.*—Requirements in ammunition, pyrotechnics, antitank mines, and chemicals are based on tactical considerations. Ammunition and other items of class V supplies normally are made available in the form of credits in designated depots. Stockage of army depots is effected through calls against credits in communications zone depots. Such calls are sent through the regulating officer who causes the necessary shipments to be made. Based on periodic expenditure reports as well as the status of ammunition supply and requirements of the tactical situation, the army allocates ammunition to the corps, which, in turn, reallocates it to divisions and corps troops. Trains of divisions and similar units obtain class V supplies from army depots or other designated supply points established by the army, and deliver it to distributing points where it is obtained by the trains of regiments or battalions.

*g. Administrative orders.*—Supply and evacuation procedure in armies, corps, divisions, and smaller independent commands is promulgated by means of administrative orders.

■ **32. FUNCTIONS OF COMMUNICATIONS ZONE.**—*a.* A communications zone is commanded by an officer designated by the theater commander. The communications zone commander is provided with a suitable staff and the necessary service

and combat troops for the operation and protection of the communications zone. In addition to the procurement and distribution of supplies and matériel of all kinds for the theater of operations, the communications zone provides the following:

- (1) Facilities for evacuation and hospitalization for men and animals.
- (2) Transportation for men and supplies.
- (3) Depots for replacements and casualties.
- (4) Rest camps, leave and quartering areas, and training centers.
- (5) Facilities for the reception and care of salvage.

b. The communications zone commander is responsible for the maintenance of stocks in depots supplying the combat zone and for the operation of the military railways service. Under policies formulated by GHQ he designates the depots in which the army is given credits, the places to which salvage is to be evacuated, and the number of trains and other railway equipment to be made available to the regulating officer.

c. A communications zone is charged with its own defense against air attack, enemy raids, and acts of depredation by inhabitants of the area. It provides its own system of signal communications. (See FM 100-10.)

■ 33. REGULATING STATION.—*a.* A regulating station is an agency designed to maintain regularity in supply and evacuation movement to and from the combat zone. The officer commanding a regulating station is known as the regulating officer. He is designated by the theater of operations commander and is directly responsible to him for the operation of the station. The regulating officer is provided with necessary operating personnel and a suitable staff of assistants, including a superintendent of military railway service and representatives of each of the various supply arms and services. The installations of the station consist of tracks for the reception and classification of incoming freight, storage tracks for reserve supplies kept in cars, and departure tracks.

*b.* The principal duty of the regulating officer is to meet the needs of the army for supply and evacuation within the

limitations of the facilities at his disposition. He must be kept informed of pending operations and contemplated changes in locations of army depots and railheads. He receives, assembles, and forwards requisitions and calls for supplies, and causes the necessary shipments to be made from depots in the communications zone. He is responsible for the systematic and orderly movement of supplies from the regulating station to the front.

c. Bulk loaded trains from depots in the rear are received at the regulating station, checked and broken up for remaking of such trains as required for the delivery of supplies in the proper classes and quantities to installations in the combat zone.

d. The quartermaster transportation section of the regulating station is divided into a troop movement branch and a supply movement branch. This section receives requests for rail movements, assembles the requirements for railway transport, arranges with the superintendent of military railways for necessary movements, and insures that movements to the combat zone are in accordance with priorities and rules established by the regulating officer.

e. Each supply section is in charge of a representative of a particular chief of supply arm or service concerned. Each has, in general, the functions of any supply office. The supply section receives requisitions from the army, transmits the transportation requirements to the quartermaster transportation section, follows up the arrangements made for shipping, and notifies the army when shipments may be expected.

f. Shipments of ammunition, engineer supplies such as road-building matériel, and other bulk supplies are handled as far as possible by complete train shipments. Under no circumstances are ammunition trains stored in regulating stations. Mobile reserves of ammunition and gasoline should be stored a few miles away from the station itself. Since the regulating station is primarily a traffic control agency, depots should not be located at such stations.

g. The principles governing the organization and establishment of regulating stations on a rail-net are applicable to organized roadways when it is necessary to employ motor

or animal-drawn transport columns to supplement railways between the communications zone and the combat zone.

■ 34. REFERENCES.—*a.* For the general functions of the services and the organization and scheme of supply and transportation, see FM 100-10.  
*b.* For technical and logistical data including weapons and ammunition, supply and transport, see FM 101-10.

## CHAPTER 2

### CHEMICAL WARFARE SERVICES AND DUTIES OF CHEMICAL STAFF OFFICERS

	Paragraphs
Section I. Mission and general organization.....	35-37
II. Responsibilities and duties of chemical warfare staff officers.....	38-45

#### SECTION I

##### MISSION AND GENERAL ORGANIZATION

■ 35. FUNCTIONS.—The supply and service functions of the Chemical Warfare Service in the theater of operations are—

- a. Supply of all chemical warfare protective materials and equipment except protective clothing which is issued by the Quartermaster Corps.
- b. Repair of salvaged chemical warfare protective equipment except clothing.
- c. Operation of such chemical filling plants as it may be necessary to maintain in the theater of operations for filling of shell, mines, bombs, grenades, or other munitions in which chemical agents may be used. With the exception of certain specified items, chemical munitions after being filled are turned over to the Ordnance Department for storage and issue.
- d. Storage, surveillance, and issue of certain chemical munitions including all chemical weapons and chemical ammunition used solely by combat chemical troops. Such ammunition is referred to herein as chemical warfare ammunition.
- e. Repair and maintenance of chemical weapons used by combat chemical troops.
- f. Supply of chemical agents in bulk as may be authorized for Air Corps use, the filling of such containers as provided for the employment of these chemicals from aircraft, and the delivery of the filled containers at airplane loading points at airdromes.

*g.* Investigation of chemical agents employed by the enemy and of captured chemical weapons and material, together with the elaboration of such special protective procedure as may be required in the circumstances.

*h.* Conduct of decontamination operations requiring the employment of specially trained and equipped decontamination troops.

*i.* Removal from designated collection points of contaminated clothing and the decontamination of such clothing.

■ 36. ORGANIZATION.—*a. Officers.*—As in the case of other supply arms and services, the organization of the Chemical Warfare Service in the theater of operations is generally decentralized. (See chart p. 17) The theater of operations chemical officer is a general officer of the Chemical Warfare Service. He is the adviser to the theater commander and his staff in all matters pertaining to chemical warfare and is responsible for general technical direction of the chemical warfare supply and service activities as a whole. One or more Chemical Warfare Service officers, of suitable grade, are assigned to each headquarters, communications zone; headquarters, advance, intermediate, or base section of the communications zone; regulating station, each army, corps, and division headquarters; army service area headquarters (stabilized situation); GHQ Air Force headquarters; and each air district headquarters.

*b. Chemical service troops.*—Supply and service units of the Chemical Warfare Service now provided for are—

Chemical decontamination company.

Chemical depot company.

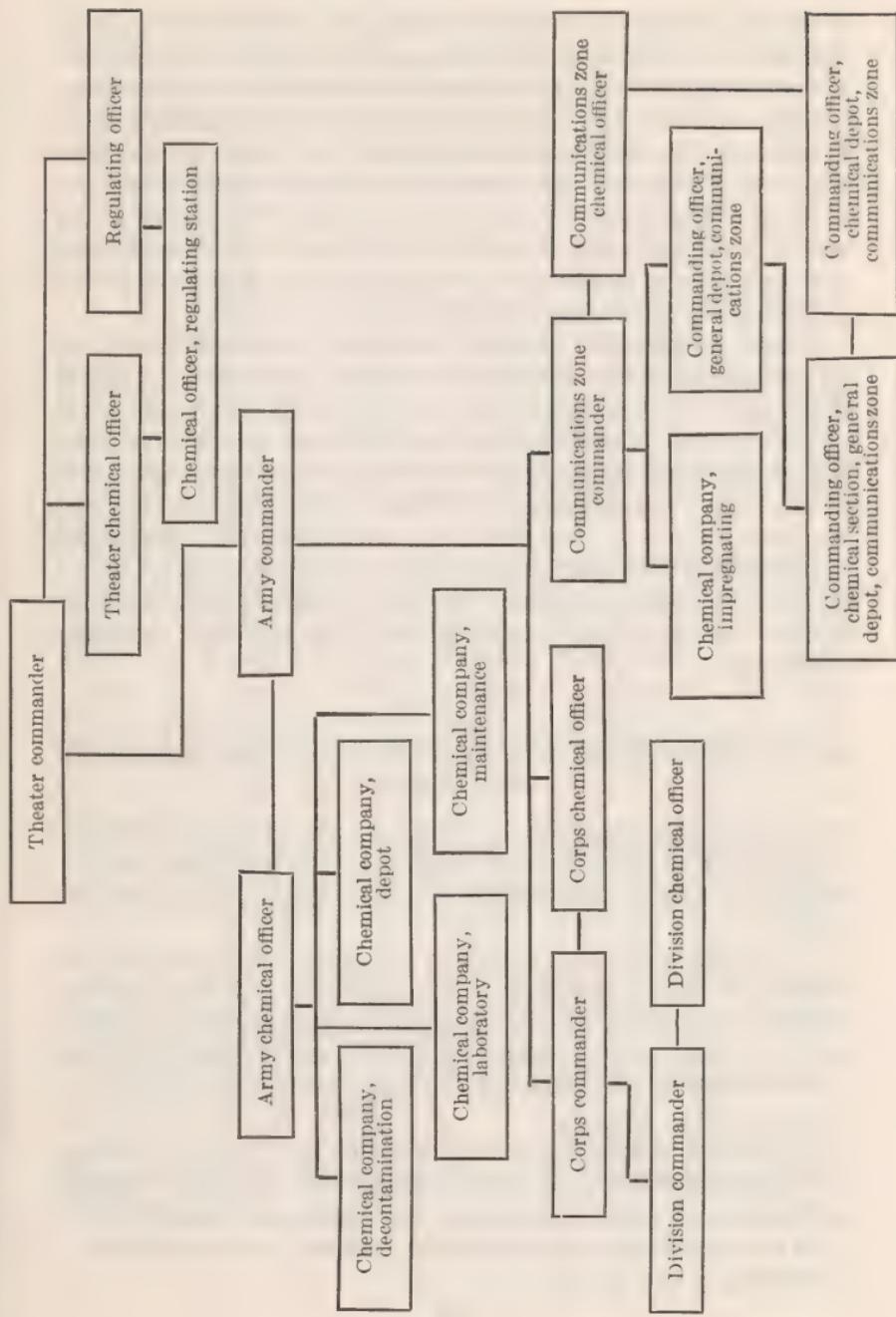
Chemical impregnating company.

Chemical laboratory company.

Chemical maintenance company.

These units are assigned to each army as required. In addition, such numbers of chemical service troops as required are assigned to the communications zone, and to the GHQ Air Force. The organization and duties of the various classes of chemical service troops are discussed in chapters 3 to 7.

## DISTRIBUTION OF SERVICE AGENCIES, CHEMICAL WARFARE SERVICE, IN THEATER OF OPERATIONS



■ 37. CHANNELS OF COMMUNICATION.—*a.* There are two recognized channels of communication between military commands: command and technical channels. Communications within the command channels are either signed by the commander or authenticated by a general staff officer or adjutant general. In order to keep this channel free from many details of administration which are handled by special staff officers, the technical channel is employed. In this channel correspondence is direct between special staff officers of the same arm or service at different headquarters.

*b.* Matter handled through technical channels should not be such as to require action of any other staff officer of either command. It should be confined to normal technical operations of the service which the special staff officer represents and to such information and reports as have been authorized by a higher commander. Nothing that requires the announcement of a new policy or variation from prescribed methods will be handled through technical channels. Much of the intercommunication between chemical warfare staff officers in the field probably will be through technical channels.

## SECTION II

### RESPONSIBILITIES AND DUTIES OF CHEMICAL STAFF OFFICERS

■ 38. THEATER CHEMICAL OFFICER.—*a.* The chemical officer of the theater of operations is provided with a suitable staff of assistants and is responsible to the theater commander for the—

(1) Preparation of a complete project for organization and operation of the chemical warfare supply and field service, and its expansion as may become necessary in accordance with the general organization project and approved priorities.

(2) Efficient operation of the chemical warfare service of the theater as a whole.

(3) Establishment and maintenance of uniform methods of administration and procedure for all chemical warfare activities and establishments in the theater of operations.

(4) Cooperation with chemical warfare representatives in subordinate commands.

(5) Development of new, improved, or special types of chemical warfare supplies as may be necessary to meet the particular requirements of the theater of operations.

(6) Publication of definitions of a "unit of fire" for the ammunition used solely by chemical troops, and a "day of supply" with respect to all chemical warfare supplies.

(7) Recommendations relative to the supply levels to be maintained in the various echelons of the theater of operations.

b. In drawing up the chemical warfare project, the theater chemical officer is concerned largely with major decisions, leaving the detailed supply computations to the communications zone chemical officer. The theater chemical officer exercises technical control over Chemical Warfare Service activities through the communications zone chemical officer, the chemical officer at the regulating station, and the chemical officers of combat units.

c. The theater chemical officer is the representative of the Chief of the Chemical Warfare Service. He necessarily is charged with the task of carrying out that portion of the mission of the Chief of the Chemical Warfare Service, which pertains to Chemical Warfare Service activities in the field. The theater chemical officer therefore should be familiar with the specific war plans concerned, especially with those features of it prepared in the office of the Chief of the Chemical Warfare Service, such as—

(1) A statement of the chemical warfare equipment to be taken into the theater of operations by units and individuals.

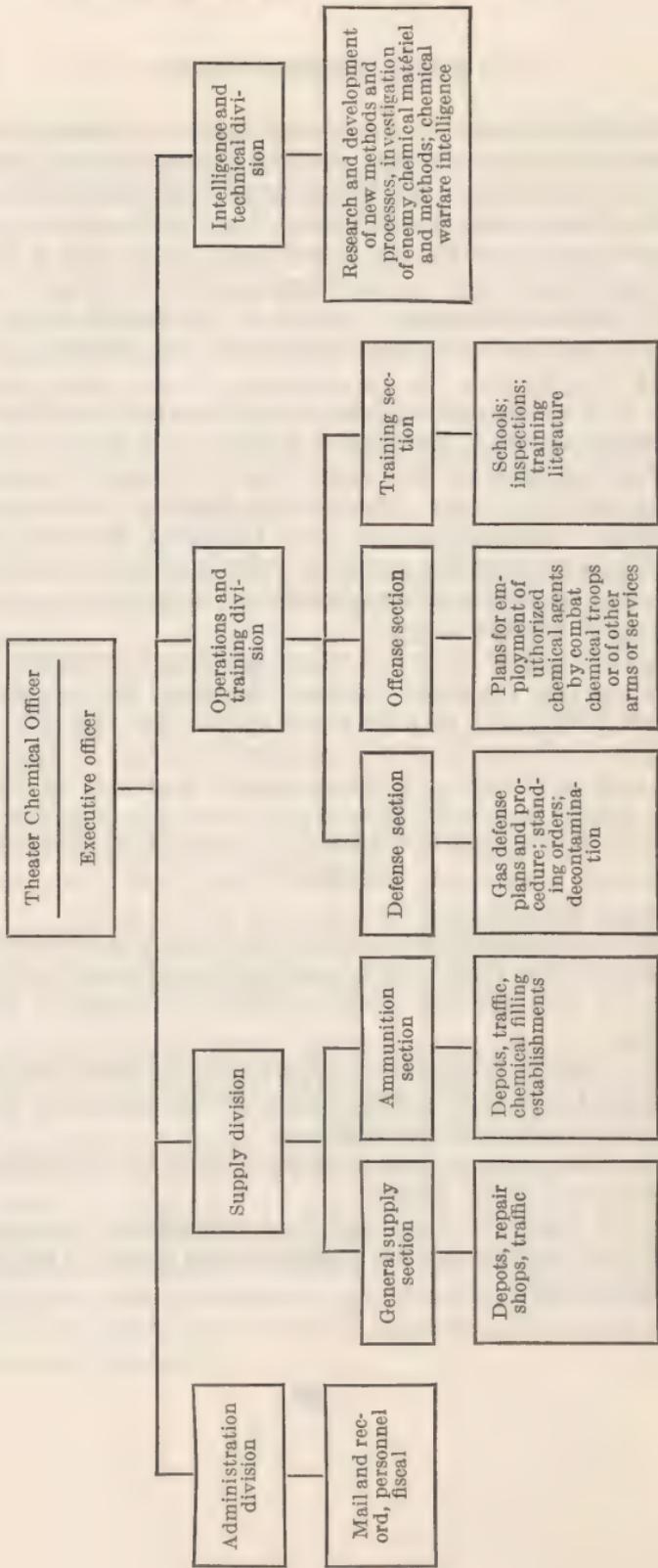
(2) A plan for the initial stockage of chemical warfare depots.

(3) Plans for subsequent procurement of chemical warfare supplies, together with schedules of availability, when supplies are not immediately available.

(4) Such plans as may have been made for procurement of supplies within the theater.

(5) A plan for the initial and subsequent movement of Chemical Warfare Service personnel and troops to the theater of operations.

## ORGANIZATION OF OFFICE OF CHEMICAL OFFICER, THEATER OF OPERATIONS



(6) A plan for the utilization of civilian labor in chemical warfare activities in the theater.

(7) Such arrangements as made with other arms and services for necessary facilities, including shelter, to be provided by them for chemical warfare establishments in the communications zone.

(8) A plan for the equipment of these establishments.

(9) A plan for financial transactions involved in chemical warfare activities in the theater.

(10) A plan for the training of Chemical Warfare Service personnel in the theater of operations.

d. In a war in which the employment of chemical agents assumes major importance, the office of the theater chemical officer may require an organization along the lines indicated in the chart, page 20.

■ 39. CHEMICAL OFFICER, COMMUNICATIONS ZONE.—*a.* The chemical officer on the staff of the communications zone commander is charged with the following responsibilities:

(1) Recommendations to the communications zone commander as to the location, equipment, and stockage of arm or service depots for chemical warfare general supplies and ammunition, chemical filling plants, and such other chemical warfare establishments as may be required in the communications zone.

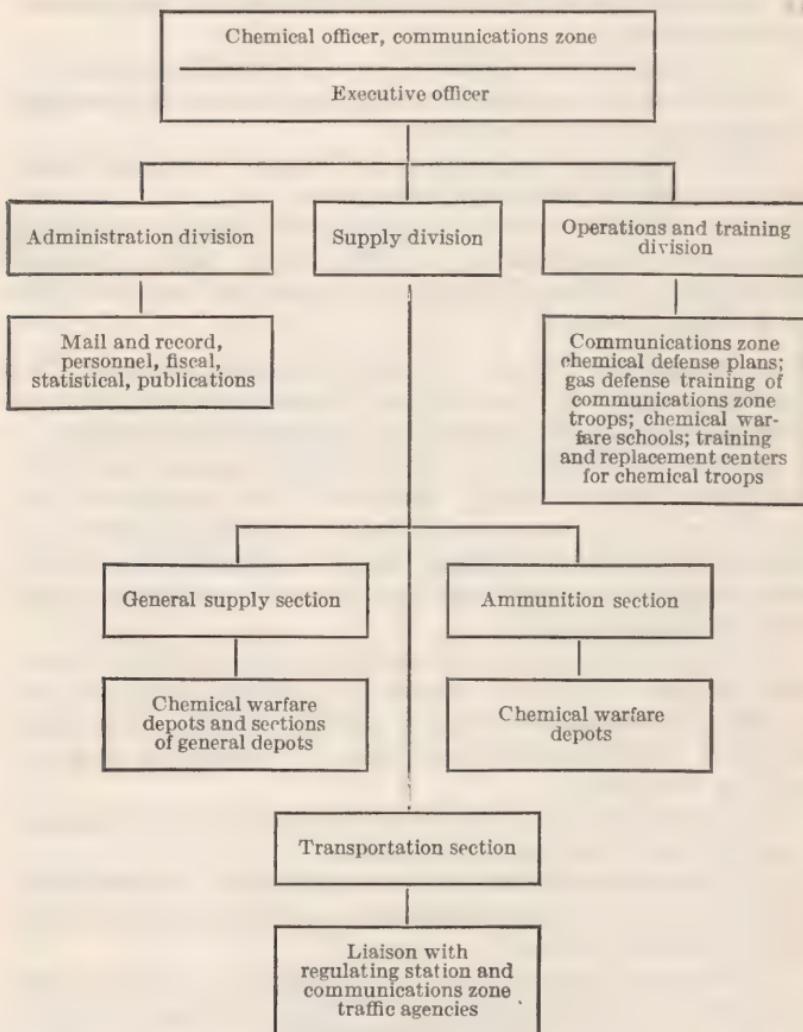
(2) Maintenance of the prescribed levels of chemical warfare supplies in arm or service and general depots in the communications zone through periodic reports of supplies on hand in depots and timely calls or requisitions upon the zone of the interior.

(3) Supervision of such local procurement of chemical warfare supplies as may be directed.

(4) Recommendations for the appointment of commanders of chemical warfare depots, and of chemical warfare sections of general depots.

(5) Recommendations for the provision of such chemical warfare depot units and other chemical service troops as required in the operation of the communications zone, and proper assignment of such units to communications zone establishments.

**ORGANIZATION OF OFFICE OF CHEMICAL OFFICER,  
COMMUNICATIONS ZONE**



(6) Command, insofar as relates to operations of chemical troops, assigned to the communications zone.

(7) Recommendations as to the location and equipment of and the assignment of personnel for such chemical warfare schools, replacement, and training centers as the communications zone may be called upon to establish.

(8) Supply and technical inspection of chemical warfare supplies issued to communications zone establishments and troops.

(9) Supply of chemical warfare equipment and materials to Air Corps units operating from and quartered in the communications zone, and to such other troops as may be temporarily quartered there.

(10) In addition to supply and service functions, the communications zone chemical officer is responsible to the communications zone commander for plans of protection of the communications zone against chemical attack, and for technical supervision of the training of communications zone troops in gas defense.

b. In a war of major chemical effort, the office of the chemical officer, communications zone, may be organized as indicated on the chart, page 22.

■ 40. CHEMICAL OFFICER AT REGULATING STATION.—*a.* The senior Chemical Warfare Service officer on the staff of the regulating officer is a direct representative of the chemical officer of the theater. He is in charge of the chemical warfare section of the station. With due regard for the needs of other services, he should exercise initiative in procuring sufficient transport to meet the Chemical Warfare Service needs. Largely upon his efficiency, judgment, and ability to cooperate will depend the success with which army chemical officers can perform their supply and service functions. Specific duties of the chemical officer at the regulating station include the following:

(1) In the name of the regulating officer, he will make all calls on communications zone depots for the shipment of chemical warfare supplies into the combat zone in accordance with requests made on him by army chemical officers and priorities established by the regulating officer.

(2) Supervision under the direction of the regulating officer of such chemical warfare personnel as, from time to time, it may be necessary to send to railheads to handle distribution of chemical warfare supplies thereat.

(3) Responsibility for timely presentation to the transportation section of Chemical Warfare Service requirements for rail transportation.

(4) Recommendations to the regulating officer as to priority in shipment of chemical warfare supplies.

(5) Responsibility for following up requisitions for chemical supplies and insuring that shipments are made; and notifying requisitioning officers of the approximate time that shipments should arrive.

b. The chemical officer at the regulating station must be kept informed of contemplated chemical operations insofar as the movement of supplies into the combat zone will be involved. Thus, he must be in constant touch with the chemical staff officer of the army which the regulating station serves, with the chemical officer of the theater, and with the chemical officer, communications zone.

■ 41. CHEMICAL OFFICER, GHQ AIR FORCE.—a. The chemical officer of the GHQ Air Force has the same general responsibilities and duties for chemical warfare supply and services as has the chemical officer of other large commands. Specifically he is responsible to the GHQ Air Force commander for—

(1) Preparation of plans for the supply of chemical warfare protective equipment to GHQ Air Force personnel, organization, and installations; and provision of such bulk chemicals as authorized for GHQ Air Force operations. Such plans to include recommendations as to the stockage of chemical warfare supplies to be maintained at air bases and operating airdromes.

(2) Execution of such plans through establishment of the necessary chemical warfare supply agencies at GHQ Air Force stations, and general supervision of the operation of such chemical service units or detachments as may be assigned or attached to the GHQ Air Force.

(3) Command insofar as relates to operations, of all chemical warfare personnel on duty with the GHQ Air Force, not assigned or attached to subordinate units thereof.

(4) General supervision of training of GHQ Air Force personnel in protection against chemical agents.

(5) The chemical officer of the GHQ Air Force should be kept advised of all contemplated GHQ Air Force operations involving the use of chemicals or chemical warfare equipment, in order that he may make timely provision for their supply.

b. The chemical officer, GHQ Air Force, is the representative with the GHQ Air Force of the chemical officer at GHQ, and, in technical matters pertaining to chemical warfare, is responsible for adherence to service policies promulgated by the theater commander.

■ 42. ARMY CHEMICAL OFFICER.—*a.* The army chemical officer is the adviser to the army commander and his staff in all matters pertaining to chemical warfare. His responsibilities, with respect to supply and technical services, include the following:

(1) Timely provision for requirements of the army in chemical warfare supplies in accordance with tactical plans.

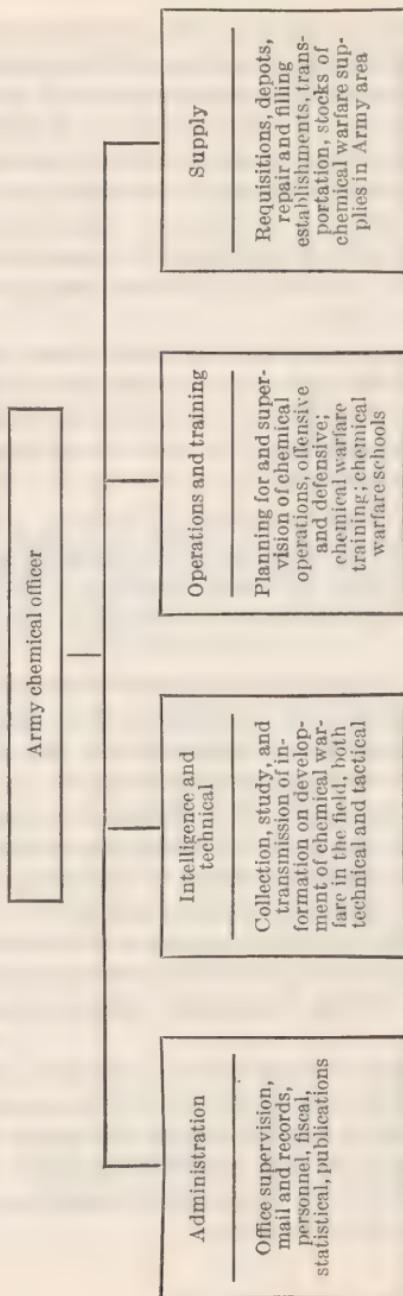
(2) Recommendations upon which the chemical warfare section of the army supply plan is based.

(3) Execution of the army supply plan, insofar as chemical supplies are concerned, including the command of chemical service troops and installations in the army area not assigned or attached to subordinate commands.

(4) Establishment and operation of the necessary depots or other chemical supply points in order to place chemical warfare supplies within practicable haul of front line divisions and corps.

(5) Operation of maintenance and repair facilities for the salvage and repair of chemical warfare equipment and matériel. Salvage activities of the Chemical Warfare Service consist principally in the rehabilitation and reconditioning of chemical warfare maintenance equipment, including the decontamination of clothing.

## SUGGESTED ORGANIZATION OF OFFICE OF ARMY CHEMICAL OFFICER



- (6) Technical inspection of chemical warfare equipment.
- (7) Assignment of tasks to decontamination troops of the army, not attached to subordinate commands, and general supervision of their operations.
- (8) The collection of information concerning chemical warfare matériel and chemicals used by our forces and the chemical means employed by the enemy.

b. The supply and service duties of the army chemical officer are closely related to his functions with respect to chemical warfare intelligence, training, and operations.

c. The army chemical officer must be informed promptly of enemy chemical attacks, the location and extent of the areas affected, the resulting casualties, and the kind of chemical agent used in each instance.

Samples of the chemicals used, if unknown, should be sent without delay to the army chemical officer for investigation by the chemical field laboratory. Only through timely information of such attacks can proper services be rendered in decontamination and supply of such regular or special protective materials and equipment as may be indicated in the circumstances. Proper anticipation of the needs of troops for chemical warfare equipment and materials necessarily involves advance information by the army chemical officer of the army commander's plans, and of the plans of the enemy insofar as they are known or estimated.

d. Adequate provisions for stockage of the army chemical warfare ammunition depot with chemical warfare ammunition and the allotment of credits therein to subordinate commands, necessitate timely information of all plans for the employment of combat chemical troops.

■ 43. CORPS CHEMICAL OFFICER.—*a.* The chemical officer of a corps acting independently or a corps which, for any other reason is charged with responsibility for its own supply, has the same duties and responsibilities with respect to the corps as has the army chemical officer with respect to the army.

*b.* In the normal case of a corps, part of an army, the chemical officer is responsible for the chemical warfare supply of corps troops, and is concerned with the supply of the

divisions of the corps only to the extent of being assured that their needs are adequately met.

c. The corps chemical officer exercises command, insofar as relates to operations of any attached chemical service troops which are not attached by the corps to subordinate units.

d. When combat chemical troops are attached to a corps, the corps chemical officer is concerned in plans for their employment and is responsible for necessary arrangements with the army, through proper channels, to insure their ammunition supply. If the chemical troops are to be employed in operations under direct control of the corps commander, the chemical officer makes recommendations for the allotment of ammunition to them, within, or to the extent of, such amount as credited to the corps in the army chemical warfare depot. If the chemical troops are attached to divisions, the corps chemical officer makes recommendations to the corps G-4 for the allotment of credits for chemical warfare ammunition to each division concerned in accordance with approved plans for the employment of the chemical troops and the ammunition available.

e. In some cases to facilitate supply, corps ammunition or other supply points may be established by a corps forward of the army depots. In such cases, where chemical warfare supplies are involved, the corps chemical officer is responsible for necessary arrangements for the stockage, handling, and issue of the chemical warfare supplies at such points.

f. The organization of the office of the corps chemical officer should be similar to that of the army chemical officer.

■ 44. DIVISION CHEMICAL OFFICER.—*a.* Of all the Chemical Warfare Service staff officers in the field, the division chemical officer is in closest contact with combat troops. Through frequent inspections or informal visits to subordinate units of the division, he should determine existing and future chemical supply needs, and take the necessary action to meet them. He prepares and submits the calls for chemical warfare supplies which are provided through army depots on the credit system. Requisitions of units of the division for chemical warfare supplies obtained by that means are submitted

to his office for approval, consolidation, and forwarding. When supplies are to be obtained, the division chemical officer either arranges with the unit or units concerned to send direct to the proper army or corps chemical depot for them or calls upon the division G-4 for the necessary transportation. In the latter case, the supplies are taken to a division distributing point where issues to units are made.

b. At times the division chemical officer may find it desirable to provide a small stock of gas masks or other supplies, particularly decontamination materials, at a division dump where they may readily be available to meet the current needs of units during battle or at other times. Such stocks should not exceed the estimated requirements for a short period, since the division chemical officer has no means for storage and transport under his immediate control.

c. When combat chemical troops are attached to a division, the division chemical officer is concerned with plans for their employment. Based on these plans, he is responsible for proper action to meet the needs of the chemical troops for chemical warfare ammunition and other supplies, and for maintenance and repair services. Within the amount of chemical warfare ammunition made available to the division, the chemical officer recommends to the division G-4 the allocations to be made to the brigades or regiments to which chemical units are attached. During the course of battle, the chemical officer must keep informed of the progress of the action, know the status of chemical warfare ammunition supply and requirements, and anticipate future needs by timely action to modify or increase the amounts made available to the chemical units.

d. Decontamination of ground, roads, buildings, installations, and equipment of immediate necessity for combat units is primarily a function of the units themselves. Such work is carried out under the supervision of unit gas officers. It is the duty of the division chemical officer to arrange for the supply of the necessary decontamination materials and equipment, and to render all possible technical advice to those concerned. In the case of contamination of a large amount of

equipment, or of a considerable area, requiring the coordinated and concerted effort of a considerable number of men in decontamination work, the division chemical officer may be placed in charge of the entire work, such details of men and officers as necessary to accomplish it being directed to report to him for orders.

When in the opinion of the division chemical officer the contamination in the division area is of such extent or severity as to make it desirable to request army decontamination troops, he should initiate a request to army headquarters therefor. When requests for such troops are made to division headquarters by commanders of subordinate units, the chemical officer will submit them to the division chief of staff with his recommendations thereon. Insofar as practicable, without undue loss of time, the division chemical officer before recommending approval of a request for special decontamination troops should assure himself that the need for them is urgent.

■ 45. UNIT GAS OFFICERS.—Gas officers of battalions, regiments, and similar units should keep informed of the status of chemical warfare materials and equipment in their units, cause such repairs as practicable within the units to be made, and initiate timely requisitions to meet supply and maintenance requirements. In technical matters pertaining to their duties, it is customary to permit direct communication between unit gas officers and the division chemical officer.

## CHAPTER 3

### SUPPLY

	Paragraphs
SECTION I. Supply channels and installations-----	46-47
II. Chemical depot company-----	48-56

#### SECTION I

##### SUPPLY CHANNELS AND INSTALLATIONS

■ 46. **ZONE OF THE INTERIOR.**—The procurement or manufacture of chemical warfare equipment and material is a statutory function of the Chief of the Chemical Warfare Service. Supply emanates from the zone of the interior and hence it is there that the basic supply agencies of the service are located. These consist of procurement offices through which the resources of commercial industry are made available for the production of numerous items of equipment and materials, manufacturing arsenals operated entirely by the service, and depots where stocks are stored against the needs of troops on mobilization and their subsequent requirements in the theater of operations. War reserves of certain items are maintained in peacetime at certain limited levels and are added to from time to time as funds for that specific purpose are made available. Upon mobilization, procurement activities are stepped up in accordance with estimated needs as indicated by the character of the emergency. (See MR 4-1.) Procurement planning is therefore based upon mobilization plans. Initial requirements of troop units to be mobilized are calculated from Tables of Basic Allowances, and, for certain specified items, from special procurement authorizations of the War Department. Issues in conformity with these requirements are made to troop units at mobilization centers or concentration areas in the zone of the interior before these troops enter the theater of operations. Provision for maintenance requirements and replacement of material consumed in campaign are made on the basis of predetermined estimates as laid down in "day of supply" tables. Shipments for

## GENERAL SYSTEM OF SUPPLY

CHEMICAL WARFARE SERVICE

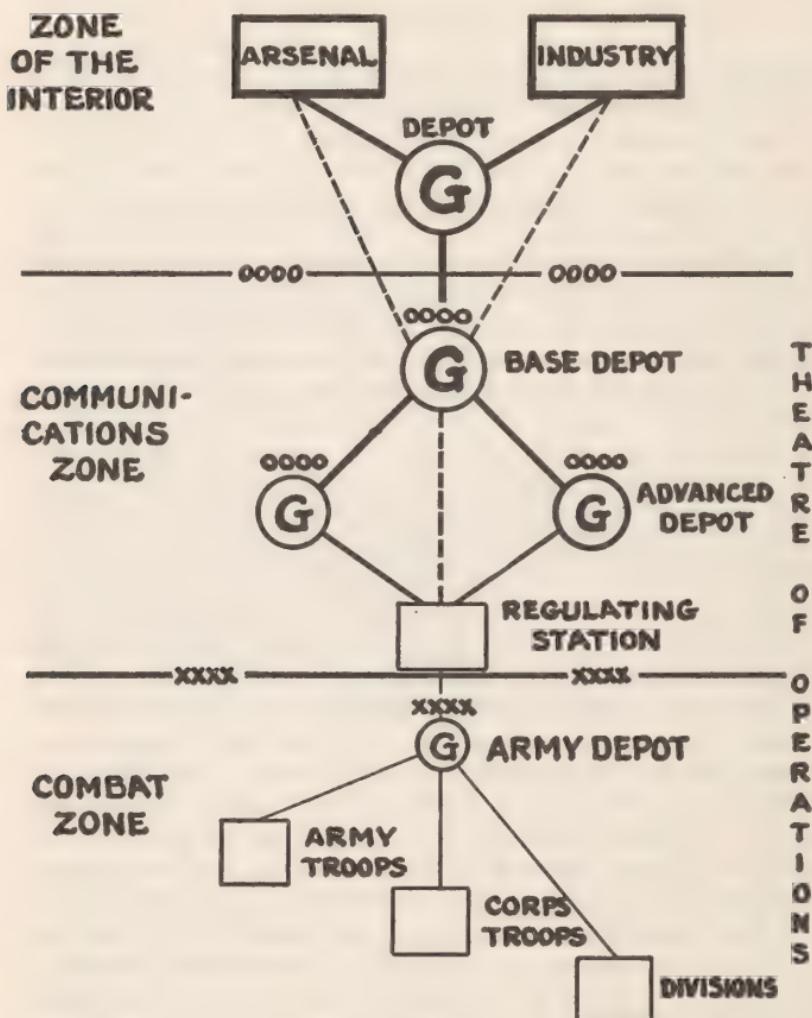


FIGURE 2.—General system of supply—Chemical Warfare Service.

this purpose from the zone of the interior to depots in the communications zone are made in accordance with a schedule of priorities determined by the theater of operations commander and approved by the War Department.

■ 47. THEATER OF OPERATIONS.—*a.* Beyond the zone of the interior, the flow of chemical warfare supplies passes from the control of the Chief of the Chemical Warfare Service into the hands of the various commanding officers who take up this responsibility until the material is actually delivered to the using troops.

*b.* In the theater of operations, through both the communications zone and combat zone, the control of flow of chemical warfare supplies is vested in the theater commander through chemical officers on his staff and the staffs of his subordinate commanders. Chemical warfare supplies reach the theater of operations at base chemical warfare depots in the communications zone. They are shipped from these depots either direct to army depots in the combat zone or to intermediate or advance depots which may be required as the communications zone is extended in depth. Intermediate or advance depots, when established, maintain balanced stocks. Their stores are arranged so as to be immediately available for issue to the combat zone. The number and location of depots in the communications zone and their stockage levels to be maintained are determined by the theater commander. In addition to supplies shipped to the combat zone, there will be some issue of chemical warfare supplies from depots in all sections of the communications zone for activities and installations in that zone, namely, concentration areas, training centers, replacement centers, communications zone troops, and other troops temporarily held in that zone.

*c.* Shipment of supplies to the combat zone usually is made from the nearest communications zone depot. In an emergency, however, or when the rail net makes it advantageous, intermediate or even base depots are called upon for these supplies by the regulating officer.

*d.* In the combat zone, chemical warfare supplies are obtained from the army chemical warfare depot, the stockage of which is determined by the army commander in accordance

with estimated needs of troops. This stockage varies from time to time depending upon the tactical situation.

e. Estimates for stockage of army chemical warfare depots to meet the requirements of troops for a definite period, or for a particular operation, are prepared by the army chemical officer and submitted to the army G-4 for approval. Requisitions or calls for supplies for stockage of the army chemical warfare depot are sent by the army to the regulating station where arrangements for their shipment from the proper communications zone depot to the army depot are made by the chemical warfare staff section of that station. Supplies are issued by the depot on requisition or on calls against credits established for troop units. Details of the procedure involved in the reception, handling, and issue of chemical warfare supplies to troops are set forth in section II covering the organization and functions of a chemical depot company.

## SECTION II

### CHEMICAL DEPOT COMPANY

■ 48. FUNCTIONS.—The function of the chemical depot company, as its name indicates, is the operation of a chemical warfare supply depot. This involves the reception, storage, surveillance, issue, and shipment of chemical warfare supplies. The company is organized and equipped to operate one depot, and is generally self-sufficient for that purpose. At times, the temporary assistance of quartermaster labor troops and provision of additional motor transportation may be necessary. In the case of the establishment of an exceptionally large depot, two or more depot companies may be required to operate it. Chemical depot companies furnish such detachments as necessary for the operation of the chemical warfare supply sections of general depots.

■ 49. ORGANIZATION.—a. A chemical depot company is organized along military lines for administration, discipline, and limited defense, as well as for technical services. It consists of a company headquarters including mess, supply, and administrative personnel, and a number of service platoons. Details of its organization are set forth in Tables of Organization. As these Tables are subject to modification from

time to time, only the general scheme of organization of the company is considered in this manual.

b. For technical operations, the company is divided into two principal divisions—

Operations division.

Administrative division.

(1) The *operations division* is divided into sections for the handling of chemical warfare protective equipment, weapons, ammunition, bulk chemicals, and miscellaneous articles of chemical warfare supplies.

(2) The *administrative division* is divided into four sections as follows:

(a) The military administrative section which has to do with the interior administration of the unit, its mess, and supply.

(b) The depot records section which is charged with the preparation of stock records, inventories, requisitions, shipping tickets, and other paper work involved in the reception, storage, and issue of supplies.

(c) The transportation section which is charged with the supervision of traffic and the operation of transportation in the depot area.

(d) The labor section which is charged with the assignment of tasks to labor personnel and the supervision thereof.

■ 50. EQUIPMENT.—a. Chemical depot troops are provided with small arms for personal protection, and a limited number of machine guns are issued each company for supplementary antiaircraft defense. Other than this, the company has no offensive equipment or combat functions.

b. The organizational equipment of the depot company includes such few motor vehicles as are likely to be required at all times in the operation of a depot. For movement of the unit or the depot, and for transporting large quantities of supplies from railheads to the depot, additional transportation must be provided. Other equipment of the company includes apparatus for transferring chemicals from bulk containers, scales, push carts, wheel barrows, light hoisting and conveying machinery, protective clothing, decontamination, materials and equipment, and first-aid supplies.

■ 51. TRAINING.—*a.* The training of the depot company is prescribed in mobilization training programs. It consists of basic military training and technical training. The military training is limited to essentials for discipline, defense, security, and such interior guard duty as required of the unit. It includes a limited amount of training of selected personnel in automatic rifle antiaircraft fire, and some training in the functioning and use of chemical warfare weapons. The latter is primarily for the intelligent handling of these weapons in the depot. The purely military training of the company should not be extended to the detriment of its technical training. The technical training is largely specialized. However, all personnel of the company should be familiar with the various items of chemical warfare supply, safety precautions necessary in the handling thereof, general methods of storage, packing for shipment, etc., the rules of safety involved, the use of safety appliances, and also decontamination and first-aid procedures.

*b.* Individual specialists in the company include stock and record clerks, carpenters, mechanics, toxic gas guards and handlers, warehousemen, and truck drivers. Men with related experience in civilian occupations are usually desirable for these positions, but all must undergo additional training in the military service to qualify them for the particular type of work required of them.

■ 52. ASSIGNMENT.—Chemical depot companies are mobilized in such number as required for the assignment of one company to each field army, and for the operation of such Chemical Warfare Service depots in the communications zone as may be established.

■ 53. CHEMICAL DEPOT COMPANY IN THE ARMY.—*a. Control.*—The operations of the chemical depot company of an army are under the direct control of the army chemical officer who is responsible to the army commander for the chemical service in the army as a whole. The point at which the chemical warfare depot is established is designated in the army administrative order.

*b. Stockage.*—Supplies for stockage of the army chemical warfare depot are shipped into the army service area from

chemical warfare supply depots in communications zone or the zone of the interior, usually by railway. The chemical warfare depot commander is notified in advance of the time and place of arrival of these supplies. It is then his duty to arrange for the transfer of these supplies from the railhead to the depot, and for their disposition in the depot. Insofar as is possible, he carries out this work with the personnel and equipment of his unit. In the case of large shipments requiring additional labor and transportation, he should make timely application therefor to the army chemical officer.

*c. Movement.*—When the army advances or retires, and the chemical warfare depot is moved to a new location, advance arrangements for additional labor and transportation, if required, must likewise be made. Hence, it is necessary for the depot commander to know at all times the status of stocks in his depot and be able to determine quickly the transportation and labor required to move it.

*d. Issues.*—Normally, the issue of supplies by the depot is made in one of two ways:

- (1) On requisitions approved by the army chemical officer.
- (2) On calls against credits established by the army commander and transmitted to the depot by the army chemical officer.

*e. Records.*—It is essential that the depot keep a running record of the issues made, and the balances of the various items on hand. The depot commander should keep the army chemical officer constantly advised of the status of depot stocks.

*f. Requisitions.*—In the combat zone, no formal accounting for supplies is required, but receipt will be taken for all supplies issued. Strict adherence to formality and insistence on special forms in requisitioning supplies are avoided. Requests for supplies made in any manner by those responsible for filling supply needs of troops engaged in active operations are honored. The responsibility and the necessity for requisitions and their sufficiency and accuracy rest with the regimental or similar commander making such requisitions.

*g. Delivery to troops.*—The chemical depot company is not charged with the transportation or delivery of supplies from the depot to troop units. Normally, the chemical warfare

depot is the supply point where trains of divisions or other units are sent to receive chemical warfare supplies. At times, in order to facilitate supply by shortening the length of hauls, the army may establish and operate one or more chemical warfare supply points forward of the army chemical warfare depot. In such cases, the chemical depot company must establish, stock, and maintain these supply points, providing the necessary detachments therefor.

■ 54. CHEMICAL AMMUNITION.—*a.* Chemical depot companies stock and issue chemical munitions used exclusively by combat chemical troops, such bulk chemicals as required in the army area, and such other chemical warfare munitions as the Chemical Warfare Service may be specifically charged with furnishing. The place of storage of such ammunition and materials should be well removed from all other supply and service installations. This distance should not be less than 500 yards, and preferably more.

*b.* Chemical warfare ammunition stored in a depot is covered so as to conceal it from hostile air observation and protect it from the weather. If suitable buildings are not available, canvas paulins are used. Insofar as practicable, the ammunition piles are kept small and are separated so that the burst of a single bomb, in case of hostile air attack, will not affect more than one pile. The chemical detachment handling this ammunition is provided with decontamination equipment for emergencies.

*c.* The chemical depot troops are not charged with transporting chemical ammunition forward of the ammunition depot, or other designated Chemical Warfare Service ammunition supply points. The ammunition supply agencies of combat chemical troops carry ammunition from the depot or other designated supply points to chemical battalion distributing points where it is transferred to the ammunition vehicles of chemical companies or platoons.

■ 55. DEPOT LOCATION.—The site for the establishment of the army chemical warfare depot is determined by army G-4, to whom recommendations in the matter are made by the army chemical officer after reconnaissance. The desirable qualifications of a chemical depot site are as follows:

- a. It should be conveniently located with respect to motor roads leading to the front.
- b. It should be out of range of hostile field artillery.
- c. It should be situated so as to receive protection of anti-aircraft artillery.
- d. It should be within convenient hauling distance from a point on a railroad leading from the rear, and provided with adequate railroad siding facilities for unloading.
- e. It should have covered storage space for the protection of supplies from the weather and concealment from hostile air observation.
- f. Convenience to water supply is desirable, especially in the case of chemical ammunition.

■ **56. CHEMICAL DEPOT COMPANY IN COMMUNICATIONS ZONE.**—One or more chemical depot companies are assigned to the communications zone, the number depending entirely upon the character and amount of chemical warfare equipment involved. Such companies operate under the control of the communications zone chemical officer. Their functions are generally the same as those of the chemical depot companies assigned to armies. However, their installations usually are more of a permanent nature and more substantial. Depots should be located at points on railroads having suitable siding and housing facilities. The level of stocks to be maintained in communications zone depots is prescribed by the theater commander. The apportionment of such stocks among various depots in the zone is prescribed by the communications zone commander usually on recommendations of the chemical officer on his staff. The commander of each chemical warfare depot and each chemical warfare section of a general depot is provided with a statement showing the level of stocks of various items to be maintained therein. He is charged with keeping an inventory and with advising the communications zone chemical officer (or the depot commander in the case of a general depot) whenever such stocks fall below the required level. Orders for shipment of supplies to the front are sent to a depot by the regulating officer who causes the necessary railway cars to be spotted at the depot siding, and their removal after they are loaded.

## CHAPTER 4

### MAINTENANCE

	Paragraphs
SECTION I. General-----	57-61
II. Functions-----	62-67

#### SECTION I

##### GENERAL

■ 57. SCOPE AND RESPONSIBILITY.—*a.* Maintenance of chemical warfare equipment issued to troops involves a twofold responsibility. Unit commanders are responsible for the proper use and care of the chemical warfare equipment issued, and with such repair of equipment as can readily be made with the limited facilities provided them. The practicability of such repair work by combat units, however, may vary considerably in different situations. Minor repairs to and limited replacement of parts of gas masks usually can be made by troops with the company or regimental mask repair kits issued. In some cases, however, the circumstances may dictate the immediate replacement of even slightly damaged gas masks by serviceable equipment, the damaged masks being turned over to a Chemical Warfare Service agency of the army for repair and return to stock. Excepting the limited repair work done by troop units themselves, the maintenance functions of the Chemical Warfare Service are as follows:

- (1) Repair of all gas protective equipment and appliances.
- (2) Cleaning, repair, and rehabilitation of weapons used exclusively by chemical combat troops.
- (3) Salvage duties with respect to chemical warfare equipment and in connection with the decontamination of contaminated clothing.
- (4) Operation of such chemical filling or refilling establishments as may be necessary in the field for the provision of certain munitions.

b. Chemical filling operations in the field may vary considerably as to the location of establishments and character of the work performed. In some cases it may be feasible and desirable to carry out this work in the army service area. In others, circumstances may dictate confining such activities to the communications zone. Should the nature of the campaign necessitate extensive work of this character, specially organized and trained munitions filling units will be required.

c. These chemical service activities, particularly those in connection with salvage operations, must be coordinated with such other supply arms or services as are concerned.

■ 58. REPAIR OF PROTECTIVE EQUIPMENT.—It is essential that all classes of gas protective equipment, both individual and collective, in the hands of troops be maintained in a constant state of serviceability. To insure this and avoid having to maintain excessively large stocks of supplies in army depots, chemical maintenance troops are included in the organization of the army. Items of equipment such as gas masks and gas-proof shelter curtains which are damaged and require major repairs involving sewing and other machine processes are replaced by new issues. The damaged articles are collected, repaired by the maintenance company, and returned to depot stocks. Items of equipment which are more or less permanently installed, such as collective protectors, may sometimes be repaired in place by sending out a maintenance detachment for the purpose.

■ 59. SERVICING CHEMICAL WARFARE WEAPONS.—Combat chemical troops attached to an army will require more or less continual technical services for the repair and maintenance of their weapons. In the case of large scale chemical warfare operations involving use of such weapons as Livens projectors or chemical cylinders, the projector tubes or discharged cylinders, if they are to be used again, must be collected, overhauled, and cleaned after the operation is completed. Such work usually cannot be expected of the combat chemical units. Consequently special chemical warfare weapons, after use, are collected by chemical service troops, brought to the rear, reconditioned as necessary, and

placed in the depot pending need for their use elsewhere. In addition, the chemical mortars of combat chemical units, although of simple and rugged construction, must be overhauled and repaired from time to time.

■ 60. SALVAGE SERVICE.—*a.* The collection of salvage material on the battlefield and its delivery to salvage dumps (usually unit distributing points) are functions of combat units themselves. In general, the collection of such salvage material from these points, the sorting, and the delivery to repair agencies of the various branches to which the material pertains are functions of the Quartermaster Corps. Items of chemical warfare equipment thus recovered are normally delivered to the chemical maintenance company for repair and return to the depot stock or such other disposition as may be indicated.

*b.* Some variation from this routine procedure becomes necessary in the case of salvaged material which has been contaminated by mustard gas or similar agents. In case it is necessary to carry on salvage collection operations in areas which have recently been subjected to attack of such agents, contaminated heavy equipment such as field guns, trucks, etc., may have to be decontaminated on the spot before it can be moved and handled with safety. Such salvage work may necessitate the detail of special chemical decontamination troops.

*c.* The removal of contaminated clothing from salvage dumps, its decontamination by special chemical companies, and delivery to appropriate quartermaster installations for further disposition are duties charged to the Chemical Warfare Service. In some cases, it may be practicable to carry out the clothing decontamination work at or near the salvage dumps. If this cannot be done, the clothing, packed in suitable containers if possible, is shipped to decontamination points in the communications zone.

■ 61. CHEMICAL FILLING OPERATIONS.—*a.* In warfare in which toxic gas is employed, certain chemical munition filling operations must be carried out in the field. These operations involve the filling or refilling of portable chemical cylinders and the filling of chemical land mines. The light construction of the containers makes it undesirable, for safety purposes, to

stock large quantities of loaded mines in rear depots or ship them over long distances. In addition to these filling operations, it may at times be necessary to fill Livens projector shell in the field.

b. The equipment required for chemical filling work is considerable and involves certain refrigeration apparatus necessary for keeping the chemical in a proper state for reasonably safe handling during the filling process. It is probable that in each case where such operations are required, special arrangements will have to be made including the provision of experienced technicians. At times, it may be practicable to carry on this work in the army service area. In such case, the chemical maintenance company of the army will either be charged with the work, or with furnishing men to assist specially qualified technicians sent from the communications zone. Generally it will be desirable to carry out chemical filling operations in the communications zone, providing specially trained detachments for the purpose.

## SECTION II

### CHEMICAL MAINTENANCE COMPANY

■ 62. FUNCTIONS.—a. The functions of the chemical maintenance company assigned to an army are those chemical maintenance services described in section I.

b. Chemical maintenance troops are not charged with general decontamination duties but they must be equipped for and familiar with decontamination processes necessarily involved in their salvage operations. This work, at times, may be considerable. Moreover, in the case of an emergency, chemical maintenance troops may be called upon to assist other chemical units in major decontamination operations.

■ 63. ORGANIZATION.—A chemical maintenance company is organized for military administration, discipline, and limited defense in the same manner as a chemical depot company. The maintenance company consists of company headquarters and a number of special service platoons for repair and salvage operations. The organization for technical services must be flexible, readily permitting the formation of detach-

ments for the various maintenance duties previously discussed.

■ 64. EQUIPMENT.—Chemical maintenance troops are armed similarly to and for the same limited purposes as chemical depot troops. The organizational equipment includes a portable gas mask repair plant, light machine shop equipment, machine tools and spare parts for rehabilitation of chemical weapons, and certain decontamination materials and equipment. Such motor vehicles as are required constantly by the company are provided as organic equipment. For movement of the entire unit by motor or for transporting large quantities of salvage material, additional trucks must be supplied. For special operations that may be required of the company, such as chemical treatment of contaminated clothing and filling of chemical munitions, a special apparatus is provided as required.

■ 65. TRAINING.—The military training of the chemical maintenance company is of the same nature and scope as that of the chemical depot company. All members of the maintenance company should have a sound practical knowledge of chemical agents, their action on materials and equipment, decontamination and first-aid processes, and the rules of safety pertaining to handling of dangerous chemicals. The technical training of the company should be broad with a view to interchangeability of men for any of the various maintenance activities. However, certain specialists must be developed. These include sewing machine operators for repair of gas masks, mechanics for repair of chemical weapons and collective protection machinery, and supervisors for chemical salvage operations and chemical munition filling. The detailed program for training of a chemical maintenance company is set forth in mobilization training programs.

■ 66. LOCATION.—For operations, the chemical maintenance company usually should be established centrally in the army service area, near the chemical warfare depot. At times, the chemical maintenance company may be required to assist depot troops temporarily in supply operations.

■ 67. ASSIGNMENT.—One chemical maintenance company is assigned to each field army. The company operates under the control of the army chemical officer. In case the field forces are very large, and extensive chemical operations are being conducted, it may become necessary to provide one or more additional chemical maintenance companies for the communications zone.

## CHAPTER 5

### DECONTAMINATION

	Paragraphs
SECTION I.	68-73
I. Scope and responsibility-----	68-73
II. Chemical decontamination company-----	74-79

#### SECTION I

##### SCOPE AND RESPONSIBILITY

- 68. DEFINITION.—The term “decontamination” applies to the chemical or physical processes involved in the eradication of mustard gas or similar persistent agents from ground, buildings, material, or equipment.
- 69. PURPOSE.—The purpose of decontamination is to minimize the danger of casualties which may result through direct contact of personnel with gas contaminated surfaces, or by exposure to toxic vapor given off from such gases.
- 70. NATURE.—Decontamination is closely allied to first-aid measures for protection against vesicant gas, and involves, very largely, the same processes as the latter. Decontamination is a safety measure taken to remove a source of danger, while first-aid is treatment applied to the body to prevent the development, or lessen the severity, of burns due to gas exposure. Decontamination applies to inanimate things; first-aid to persons and animals.
- 71. RESPONSIBILITY.—*a. All arms and services.*—The primary responsibility for decontamination work essential for the protection of troops, equipment, or supplies rests with the commander of the unit immediately concerned. (See FM 21-40.) So great is the danger of skin burns and eye casualties from exposure to vesicant gas vapor that every effort must be made to eliminate this danger at its source as soon as discovered. A single mustard gas shell burst may pollute the atmosphere for a distance of 200 yards or more down wind of such source. The danger of direct contact with droplets

of such gas through handling of contaminated equipment or in moving through areas sprayed or splashed with such chemical can scarcely be overemphasized. Manifestly, it would be impracticable to provide special decontamination troops to deal with all such dangers as they may occur. Certain decontamination equipment and materials are therefore made available to all combat service troops. In forward areas of the combat zone particularly, such decontamination work as is imperative will usually have to be done by combat units.

*b. Chemical Warfare Service.*—The responsibilities of the Chemical Warfare Service for decontamination are as follows:

- (1) The supply and issue of all decontamination material and equipment, and instruction in their use.
- (2) The decontamination of salvaged contaminated clothing.
- (3) The organization and training of chemical decontamination companies. Types of missions on which it is considered these units can be most profitably employed are indicated in paragraph 79.

■ **72. ORGANIZATION.**—Preparation of a plan for decontamination activities in an army area is a responsibility charged to the army chemical officer. In stabilized situations such a plan probably will involve the subdivision of the army service area into subareas, each in charge of a gas officer; the subareas being in turn subdivided into sections in each of which a decontamination squad is provided. Even in open warfare, some such arrangement with respect to the rear areas may be indicated. These arrangements, however, should not result in such dispersion of the available decontamination troops that the army chemical officer is left without a considerable number of them immediately available to him. In fast moving situations, it generally will be desirable to hold the bulk of the decontamination troops together until the echelonment of the army supply and evacuation establishments forward is under way. Detachments of decontamination troops are then sent to critical points in the new service area, the remainder of these troops following as the old area is cleared. Employment of chemical decontamination troops in the forward areas during battle will rarely be practicable.

■ 73. PROCEDURE.—Decontamination procedure is discussed in FM 21-40.

## SECTION II

### CHEMICAL DECONTAMINATION COMPANY

■ 74. PURPOSE.—Decontamination companies are provided for the purpose of dealing with major contamination problems, particularly those affecting the more or less fixed supply and evacuation establishments.

■ 75. ORGANIZATION.—The decontamination company consists of a company headquarters and 3 platoons, each platoon consisting of platoon headquarters and 6 decontamination squads. The decontamination squad is the basic work unit. Each such squad is provided with a truck for transportation of the squad and its immediate supply of neutralizing chemicals and tools. The company is motorized and organized so as to provide readily for the detachment of one or more squads or platoons for operation as a unit.

■ 76. TRAINING.—*a.* The work of a decontamination company is hazardous. In order that it may be carried on efficiently without an undue number of casualties from gas exposure, it is essential that its members be well trained in their technical duties, and provided with adequate protective equipment. This training involves instruction of all personnel in the physiological action of chemical agents, their identification, and means of neutralizing persistent gas; specific methods of treating different sorts of contaminated surfaces; adjustment and care of protective clothing; and first-aid measures. The noncommissioned officers, at least, should be specially trained in identification of persistent agents. They should be familiar with practical tests to determine the proper decontamination methods to apply in each instance, and to indicate whether eradication of gas has been accomplished. Every member of the company should have a fair understanding of these matters, appreciate the dangers involved, and be able to take the necessary safety precautions. Theoretical training should be followed by actual practice in decontamination of ground, vehicles, buildings, roads, and equipment prepared for the purpose and in the use of all various tools

and chemicals involved. Men should be taught to assist one another in the adjustment and removal of protective clothing, and in such methods of decontaminating the clothing as may be practicable in the field. Officers and noncommissioned officers of the decontamination company should be conversant with gas reconnaissance procedure in order that they make intelligent estimates of requirements for any particular task.

b. The basic military training of decontamination troops is the same as that given other chemical service units. Decontamination troops are armed with pistols for personal protection, and each platoon has two automatic rifles for supplementary antiaircraft defense. Other than this, the unit has no combat functions. Detailed programs for training these units are provided in mobilization training programs.

■ 77. EQUIPMENT.—The technical equipment of a decontamination company consists principally of supplies of chloride of lime and other neutralizing chemicals, two hand operated demustardizing apparatuses for each squad, and two power driven demustardizing apparatuses for each platoon, together with the necessary shovels and brushes and receptacles for mixing the neutralizing solutions. Motor transportation for transporting all equipment and personnel of a company is provided.

■ 78. LOCATION.—The normal position of a decontamination company assigned to an army in the field is at a generally central point in the army service area. From such point detachments may readily be sent to any affected or threatened area. At times it may be desirable to place detachments of decontamination troops in the rear of each corps or even attach such elements to the corps. In no case, however, should the dispositions made result in leaving the army chemical officer without a sizeable number of these troops immediately available to deal promptly with any gas situations in the army service area. In general, the establishment of the company headquarters in the vicinity of the location of the chemical depot of the army will be desirable.

■ 79. TYPICAL MISSIONS.—*a.* The need for immediate action in case of contamination of combat equipment in use, the vital necessity for continuous functioning of supply installations although subjected to chemical attack, and the installations limited number of special decontamination troops generally will preclude their employment in forward areas during combat.

*b.* The following tasks are considered typical missions for decontamination troops:

(1) Decontamination following gas attack against a vital communication or supply installation, such as a regulating station, railhead, depot, motor park, or supply road.

(2) Decontamination to render a town or village tenable for use of an army or corps headquarters, or evacuation hospital.

(3) Decontamination of railway cars and motor supply vehicles subjected to gas attack by aircraft.

(4) Decontamination of tanks following their return to rear areas where conditions preclude the performance of such work by tank crews.

(5) Decontamination in an area over which an attack has passed in order to permit essential salvage operations to be carried on with reasonable safety.

*c.* In assigning decontamination tasks to decontamination units, commanding officers should have a proper conception of the decided limitations of any artificial means which can be brought to bear on any situation.

(1) The use of neutralizing chemicals over a large contaminated area in its entirety, such as a field, town or woods, will generally be wholly impracticable. In dealing with such areas, usually the most that can be expected is the decontamination of small vital parts including routes to and from them. Personnel required to use such areas will necessarily have to wear gas masks until such times as the gas danger is eliminated through action of the elements.

(2) In some cases, large contaminated areas may be treated successfully by burning them off, or by hosing them down with water. If such means are not applicable, usually their decontamination must be left to action of nature.

## CHAPTER 6

### CHEMICAL LABORATORY SERVICES

	Paragraphs
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II. Chemical laboratory company	88-95

#### SECTION I

##### GENERAL

■ 80. PURPOSE.—Chemical laboratory companies are assigned to the field forces for the purpose of insuring essentially prompt scientific investigation of certain chemical warfare problems as they arise in the field. It is not possible to foresee and list all of the numerous problems requiring such investigation which may develop in the course of any campaign where chemical agents are employed. The principal functions of chemical laboratory companies are described briefly in the following paragraphs.

■ 81. IDENTIFICATION OF ENEMY GASES.—The possibility of the employment by an enemy of some new chemical agent, or of modifying some known agent so that it cannot readily be identified by troops, necessitates special provision for prompt identification of such agents. It is the duty of gas officers of units subjected to attack by such agents to obtain samples and forward them without delay to the army chemical officer for the chemical laboratory company of the army. It is the duty of the chemical laboratory company to determine the nature of the agent and make timely recommendations for any special protective measures which may be indicated in the circumstances. Aside from the obvious need for prompt identification of any new toxic substance, it is likewise important that any deceptive chemical means resorted to by an enemy, such as the use of so-called "fake gases" be revealed in time to prevent accomplishment of the purpose of their use. To be of the greatest value, the technical investigation of any such chemical agent by the laboratory should be made in the light

of reliable and comprehensive information of the circumstances under which the substance was employed. This fact, as well as time considerations, dictates the provision of the laboratory unit as an organic element of the army.

■ 82. **ENEMY MUNITIONS.**—In addition to the scientific investigation of enemy chemical agents, it is the duty of the chemical laboratory company to examine samples of captured chemical munitions or apparatus for dissemination of chemicals. Such studies may reveal new methods or means of considerable tactical importance and may indicate necessary modifications in our technical or tactical procedure.

■ 83. **ENEMY PROTECTIVE EQUIPMENT.**—It is also of outstanding importance that prompt technical investigation be made of enemy chemical warfare protective equipment. For instance, scientific study of a captured enemy gas mask might give valuable indications of the enemy's chemical warfare preparations or intentions. Samples of such equipment as obtained should therefore be forwarded without delay to the army chemical laboratory company.

■ 84. **TESTING GAS MASK CANISTERS.**—It is the duty of chemical officers and unit gas officers to keep themselves informed as to the state of serviceability of gas masks in the hands of troops. From time to time, therefore, and especially after a unit has undergone severe exposure to gas, a sample number of canisters of the masks issued the unit should be removed and replaced by new canisters, the old canisters being forwarded to the chemical laboratory for test. This test will show whether replacement of canisters for the entire unit should be made. Canister testing will provide more or less constant occupation for the laboratory.

■ 85. **OTHER PROTECTIVE EQUIPMENT.**—The chemical laboratory may be charged with observation and tests of other types of chemical warfare equipment as well as canisters with a view to report as to their efficacy under field conditions.

■ 86. **DECONTAMINATION METHODS.**—A chemical laboratory may be called upon from time to time to undertake tests to determine the effectiveness of prescribed decontamination methods and with recommending such changes as these tests

may indicate necessary. Decontamination methods are developed by arsenal experimentation, and, although subjected to stringent tests before adoption, it is obviously impracticable to duplicate combat service conditions in such experimentation.

■ 87. WATER PURIFICATION.—While, as a general rule, contaminated water should be avoided, it may sometimes be of the utmost importance to render such water safe to use. General water purification is a function of the Corps of Engineers, but where gas contamination is involved, a chemical laboratory may be called upon to assist the engineers in the application of chemical purification methods.

## SECTION II

### CHEMICAL FIELD LABORATORY

■ 88. FUNCTIONS.—The technical functions of the chemical laboratory company are as discussed in section I. The personnel of the company is provided with small arms for personal protection, but, other than this, the company has no combat functions.

■ 89. ASSIGNMENT.—One chemical laboratory company is assigned to each army. It operates under the supervision of the army chemical officer.

■ 90. ORGANIZATION.—*a.* The chemical laboratory company is organized along military lines for administration, discipline, and its own defense. It is composed of a headquarters section for the military administration, mess, and supply of the organization, a chemical laboratory, and a physical laboratory. The technical organization of the chemical laboratory company is divided into three subdivisions:

- (1) Headquarters section.
- (2) Chemical laboratory.
- (3) Physical laboratory.

- b.* The headquarters section provides for—
  - (1) Administration, military and technical.
  - (2) Intelligence in chemical operations.

c. The chemical laboratory is equipped to make tests and perform research in chemical operations.

d. The physical laboratory is equipped to make physical and mechanical tests of enemy chemical warfare ammunition and weapons.

■ 91. TECHNICAL DUTIES.—*a. Chemical laboratory.*—This section of the chemical laboratory company will perform the major part of the technical work. Analysis of gases used on the front will be made from time to time. For this purpose there will be formed one group skilled in organic analysis and determinations, one group skilled in inorganic determinations, and one group specializing in protection against chemical agents. In the case of new compounds used as chemical agents, the laboratory will determine the composition, physiological action, methods of neutralization, and methods of protection. In the case of new mixtures of old compounds, the proportion of various substances in the mixture and other information that each case may require will be obtained. For emergency protective measures the protective group will make the necessary investigation to provide the chemical protection required.

*b. Physical laboratory.*—This section will receive, open, and sectionalize enemy matériel. The fillings will be turned over to the chemical laboratory for study and the sectionalized matériel to the intelligence group of headquarters section for storage. Further, this laboratory will examine enemy shell construction, determine ratio of fillings to total weight of shell, and assist in securing complete information on enemy chemical matériel in use. This group will also construct the necessary mechanical features of emergency protective devices, and install them when necessary.

■ 92. EQUIPMENT.—*a. The equipment furnished the chemical laboratory company is classified as follows:*

- (1) Library.
- (2) Chemical laboratory apparatus.
- (3) Chemical laboratory supplies.
- (4) Physical laboratory apparatus and supplies.

*b. This equipment is especially designed for the chemical laboratory company, or so modified from standard equipment*

as to make it suitable for field use. It is for use in determining the composition and characteristics of chemical agents employed by the enemy, as far as can be anticipated at the commencement of hostilities.

c. The equipment necessary for operating the laboratories depends upon the use the enemy makes of chemicals. From time to time additional special equipment may be furnished the laboratory by the Chief of the Chemical Warfare Service, depending upon needs in the field.

The chemical laboratory company is provided with only the transportation required for the movement of its supplies and equipment. When movements of the chemical laboratory company are to be made, additional transporation for personnel must be provided. Arrangements for movements are made by the army chemical officer.

■ 93. LOCATION.—a. The chemical laboratory company is normally located as far forward as the enemy artillery situation will permit. It should be centrally placed within the army area it is to serve, with due regard to the road net, since, in most instances, the samples of enemy chemical agents, ammunition, and weapons must be brought to the chemical laboratory company for examination and analysis. Due regard must be given to concealment from enemy observation. Buildings or temporary shelters used for the laboratory must be made light proof at night, as it will often be necessary to conduct laboratory work during the hours of darkness. There should be convenient water supply facilities for the operation of the laboratory.

b. Samples of enemy chemical shells and captured chemical weapons normally will be sent through channels from front line units. In some situations, such as cloud gas attacks and enemy chemical spray attacks from the air, the time of which is known or suspected, it will be necessary for the laboratory unit to send sampling machine operators to the scene of the attack.

■ 94. REPORTS.—a. Routine reports are rendered by the commanding officer of the chemical laboratory company to the army chemical officer twice in each 24-hour period. These reports are made on a form prescribed by the army chem-

ical officer and contain information on the identity of enemy chemical agents and munitions tested.

*b.* Special reports are rendered at any time the laboratory discovers a new enemy chemical agent or munition. Special reports on surveillance of our own chemical munitions are rendered as ordered.

■ 95. TRAINING. The officers and certain enlisted personnel of the chemical laboratory company are selected on the basis of their training and experience in civil occupations along lines collateral to their military duties in the laboratory unit. Thus, the technical training of the unit in the military service is largely in adaptation of their previous training to chemical warfare problems. The basic military training of the unit is virtually the same as that prescribed for other chemical service organizations. Training programs are carried in mobilization training programs.

## CHAPTER 7

### CHEMICAL SERVICES TO THE AIR CORPS

■ 96. *General.*—In general, the character of chemical services required by the Air Corps are the same as those of the ground forces. The wide distribution of Air Corps establishments in a theater of operations, the fact that they are located frequently at considerable distances from the ground forces, and that there are certain chemical services which apply solely to air operations makes necessary separate chemical units to operate with Air Corps combat units.

■ 97. *Chemical service units.*—Tables of Organization provide for the assignment of chemical officers and chemical staff sections to the headquarters of certain aviation units and establishments. Assignments are made as follows:

a. *Chemical staff section, headquarters, GHQ Air Force.*—This staff section is a part of the GHQ Air Force Headquarters. The duties of the chemical officer, GHQ Air Force, are described in paragraph 41.

b. *Chemical staff section, headquarters, air district.*—This staff section is an integral part of the headquarters. The air district chemical officer advises the air unit commander in all matters pertaining to chemical warfare. His duties are comparable with those of the division chemical officer described in paragraph 44 except in matters of supply which are greatly enlarged and comparable to the supply duties of the army chemical officer described in paragraph 42.

c. *Chemical service company (aviation).*—This unit is provided on the basis of one per air district. Its principal functions include the supply of all chemical warfare protective appliances and decontamination materials used by air units. Personnel from this company are provided to operate power driven decontaminating apparatus which may be assigned to each airdrome and to supervise decontamination operations. The company is also charged with the sup-

ply of bulk chemicals, such as, FS smoke, used by bombardment aviation, and the equipment necessary for the use of such materials. It is charged with the service function of filling chemical tanks used by airplanes and their delivery to the airdrome. The filled tanks are installed on the plane by Air Corps personnel.

■ 98. **SUPPLY.**—Chemical warfare supplies required by air units in the theater of operations are stored in a chemical warfare depot and in the chemical warfare section of the air base service area. Normally each air district will establish one chemical warfare depot and as many air base chemical warfare sections as there are air base service areas established by the air unit. In each case it is necessary that the supply installation be in conjunction with supply installations of the Air Corps or at a station with quartermaster personnel since the supply sections are not provided with sufficient personnel for the physical handling of all supplies. Estimates on which the stockage of chemical warfare supplies at the various bases are determined are prepared by the air district chemical officer and are submitted to the air force commander for approval.

■ 99. **MAINTENANCE.**—The chemical warfare detachments assigned to bombardment groups will make minor repairs to protective appliances and equipment and such other chemical warfare equipment as used by units assigned or attached to the group. Whenever repair work required is extensive, either as to its nature or amount, new equipment will be issued and damaged equipment will be sent to the nearest general or service depot designated to receive salvaged chemical warfare matériel.

■ 100. **DECONTAMINATION.**—Air units are trained in methods of decontamination and are provided with the same decontamination equipment and supplies as are furnished to the ground forces. Insofar as possible, therefore, the GHQ Air Force units in the theater of operations must deal with their own decontamination problems. Chemical warfare detachments are provided with special power driven decontamination apparatus for the rapid decontamination of airdromes and matériel.

## CHAPTER 8

### STORAGE AND SHIPMENT OF CHEMICAL MUNITIONS

	Paragraphs
SECTION I. General.....	101-102
II. Storage.....	103-107
III. Shipment.....	108-116

#### SECTION I

##### GENERAL

■ 101. **SCOPE.**—This chapter deals with the handling and storage of chemical munitions and bulk chemicals under normal conditions where time is not a factor. These instructions will also apply during hostilities insofar as is practicable.

■ 102. **IMPORTANCE OF PROPER STORAGE AND SHIPMENT.**—Many of the chemicals used in the manufacture of chemical agents and nearly all of the chemical agents themselves may be considered as hazardous to personnel, and somewhat destructive to equipment and supplies. Where shell filled with some chemical agent and bulk chemicals or chemical agents in containers are in storage, leaks are constantly developing. Storage of any of these items requires constant care to assure the maximum safety. Chemicals and chemical agents as a whole are corrosive, especially when released into the atmosphere, even in small quantities. In large quantities of filled shell or bulk containers, experience has shown that some will develop leaks in spite of all precautions that can be taken. Just how to store these items, how to care for them, how to prepare them for shipment, how to prevent accidents, and what to do when an accident or leak occurs, are difficulties that every officer may at some time encounter. Officers charged with the storage of chemical munitions will also be required to store certain explosives and should study carefully Ordnance Safety Manual 7224, TM 9-1900, and TM 3-250.

## SECTION II

## STORAGE

■ 103. CLASSES OF MATERIALS STORED.—*a. Grouping.*—Chemical warfare supplies and munitions are grouped, for convenience, into the following three main classes or groups for purpose of storage:

- (1) Inert materials.
- (2) Explosives.
- (3) Chemical warfare ammunition.

*b. Inert materials.*—Examples of inert chemical warfare materials are chemical mortars, Livens projectors, protective equipment, gas masks, certain instructional equipment, empty shell, and empty containers. Practically no hazard is attached to the storage or shipment of any of these articles, but there is present a certain deterioration factor varying from a very low figure in the case of metallic articles to a very high one in the case of the rubber components of the gas mask. Prevention or retardation of the deterioration of inert materials is of prime importance.

*c. Explosives.*—(1) As a rule, propelling charges, fuzes, burster tubes, etc., must not be stored in the same magazine with filled chemical ammunition, or shipped in the same car with it. Thus, the storage of these components must be made in separate magazines and under separate rules and regulations. Examples of such materials include—

Propelling charge, Livens projector (black and smokeless powders), including ignition charge.

Propelling charge, chemical mortar (smokeless, non-hygroscopic powder, black powder, and ballistite).

Burster tubes, Livens projector (TNT).

Burster tubes, 4.2 inch chemical mortar (tetryl).

Time fuzes, Livens projector (fulminate of mercury and black powder).

Fuze, 4.2 inch chemical mortar (fulminate of mercury).

(2) With respect to shipments, an exception to the rule for such separation of components is made in the case of shipments into the combat zone. Except where components are specifically requisitioned, all ammunition shipped into the

combat zone, either from the communications zone or the zone of the interior, will be by complete rounds. In these shipments, each vehicle of transportation will be loaded with complete rounds; however, when other than fixed ammunition is involved, components should be segregated within the vehicle.

*d. Chemical warfare ammunition and its markings.*—(1) Chemical warfare ammunition consists of shell and other containers filled with chemical agents. Some chemical shell will have the fuze and a burster tube attached and, therefore, include an explosive as well as a chemical agent. For purposes of storage, chemical warfare ammunition is divided into four groups, viz,

- (a) *Group A*.—Persistent gas.
- (b) *Group B*.—Nonpersistent gas and smoke.
- (c) *Group C*.—Spontaneously flammable agents.
- (d) *Group D*.—Readily flammable agents.

(2) The latest approved markings for chemical agents listed under the four standard groups and also the markings formerly used are shown in table 1.

*e. Chemical agents stored in bulk.*—Chemical agents stored in bulk include chlorine, phosgene, chlorpicrin, mustard gas, chloracetophenone, titanium tetrachloride, sulfur trioxide, chlorosulphonic acid solution, and white phosphorus.

*f. Mixing of groups.*—Agents or ammunition of different groups in the storage classification stated above should not be stored together in the same building. However, when authority is obtained from the Chief of the Chemical Warfare Service, groups A and B may be stored together temporarily in the same magazine.

■ **104. CHARACTERISTICS AND HANDLING.**—*a. Inert materials.*—Only those items having rubber parts require special care in storage. (See par. 106.)

*b. Chemical warfare ammunition, group A.*—Chemical agents of the type of group A are vesicants. The containers are marked with two green bands. These substances exert but slight pressure in the containers, and are but slightly corrosive. Leaks in containers in this group are infrequent. Due to the extremely low vapor pressures of the persistent vesi-

TABLE I.—*Storage, classification of chemical agents, and identification markings of chemical ammunition*

				Ammunition markings		
		CW Symbol	Name	Present	1925	Old
Group A Persistent gas.		HS	Mustard.....	GAS-HS, and 2 bands (all in green).	GAS-HS, and 2 bands (all in green).	3 red bands.
		CN	Chloracetophenone.....	GAS-CN, and 1 band (all in red).	GAS-CN, and 2 bands (all in green).	CN in red, or CN and 2 red bands.
		CNS	Liquid lacrimator.....	GAS-CNS, and 1 band (all in red).	None.....	None.
		CNB	Liquid lacrimator.....	GAS-CNB, and 1 band (all in red).	None.....	None.
Group B Nonpersistent gas and smoke.		DM	Diphenylaminechlororar-sine.	GAS-DM and 1 band (all in red).	GAS-DM, and 1 band (all in green).	DM-TOXIC.
		CG	Phosgene.....	GAS-CG, and 1 band (all in green).	GAS-CG, and 1 band (all in green).	2 white bands.
		FS	Sulfur trioxide-chlorosul-fonic acid mixture.	SMOKE-FS, and 1 band (all in yellow).	None.....	None.
		WP	White phosphorus (yellow phosphorus).	SMOKE-WP, and 1 band (all in yellow).	SMOKE-WP, and 1 band (all in yellow).	1 yellow band.
Group C Spontaneous-ly flammable agents.		HC	Hexachlorethane burn-ing mixture.	SMOKE-HC, and 1 band (all in yellow).	SMOKE-HC, and 1 band (all in yellow).	None.
		CN	Burning mixtures of CN.	GAS-CN, and 1 band (all in red).	None.....	None.
		DM	Burning mixtures of DM	GAS-DM, and 1 band (all in red).	None.....	None.
Group D Readily flam-mable agents.		CN-DM	Burning mixtures of CN and DM.	GAS-CN-DM, and 1 band (all in red).	None.....	None.

cants, the area of danger around the magazine containing these substances is relatively small.

(1) *Mustard gas (HS).*—(a) *Description and properties.*—The impure material, which is used as a filling for munitions, is a dark brown oily liquid with a freezing point of approximately 50° F. Its chemical name is bisbetachlorethylsulfide. Its odor is somewhat like that of garlic. It is a vesicant agent, and either the liquid or vapor will produce inflammation which may proceed to a blistering of any skin or membrane. Its effects are delayed from 2 to 6 hours, and in some cases as much as 24 hours may be required for the effects to be apparent. There is no pain connected with exposure, the agent is insidious in its action, and a person can be burned without warning. Prolonged exposure to even an extremely low concentration will cause severe burns and serious lung lesions. Mustard gas can be detected by its odor in any concentration likely to produce burns. However, a person rapidly becomes insensitive to its odor after a few minute's exposure. Mustard gas is not corrosive to metals. It is not easily ignited but will burn, hence, should be kept away from all fires. When dry chloride of lime comes in contact with liquid mustard gas, it will burst into flame giving off mustard gas vapor in high concentration.

(b) *Storage.*

1. *Shell.*—Shell filled with HS should be stored in a fire-proof magazine as described in paragraph 106. All shell, boxed or unboxed, are to be piled in stacks with battens separating each tier. When unboxed shell are covered with cosmoline (rust-preventive compound), they must not be set on readily flammable material such as wood. In warm weather the coating runs down the side of the shell impregnating the wood and thereby increasing the fire hazard. Magazines containing HS filled shell or containers will be inspected for leakers by some responsible person once a day. The officer in charge of the magazine will inspect not less than once each week.

2. *Bulk containers.*—HS may be stored in steel or iron drums, or in steel ton containers. Ton containers are usually stored in the open and, when so stored, should be properly painted and placed on their sides on skids so as to permit ready inspection and removal in case of leakage. A line joining the two valves or plugs should be at the horizontal to prevent sludge from clogging the eduction tubes. When containers are equipped with valves, frequent inspections should be made to detect leaks.
  - (c) *Removal and disposition of leaking munitions.*
    1. *Shell.*—When a leaking shell is located it will be immersed in freshly prepared bleach solution. This may be made by adding 3 pounds of commercial bleach (calcium hypochlorite) to each gallon of water and stirring thoroughly. The shell is taken from the magazine while immersed in bleach solution, or it may be removed from the solution if the leak is a very slow one. In either case, it is taken down wind from the magazine area pending final disposition. Boxes or other pieces of wood contaminated with HS should be removed from the magazine and burned. Other contaminated shell and the floor should be completely decontaminated with bleach solution. All leaking shell will be reported promptly to the officer in charge of the magazine who will direct further operations. Final disposition of leaking shell or components should be made by one of the following methods:
      - (a) If practicable, leaking HS shell should be disposed of by dropping them into the ocean in deep water. If this is not feasible, the shell must be exploded or buried.
      - (b) A single leaking HS shell may be exploded by static firing. The point at which the shell is exploded should be chosen so that personnel can be excluded for a distance of about 500 yards for a period of about 48 hours. A small hole about 2 feet deep, with vertical sides, should be dug. The shell is

placed at the bottom of the pit in a horizontal position with TNT blocks placed on the outside of the shell, directly over the bursting charge. Electric detonators will be used to explode the TNT after all personnel have retired to a safe distance. The ground around the exploded shell should be thoroughly decontaminated by scattering a mixture of bleach powder and sand over it. The hole should be filled with a mixture of dry bleach powder and earth. A sign should be placed upon the fill prohibiting digging in that vicinity.

(c) Leaking HS shell may be buried without being exploded. The place selected must be at an unused portion of the post or station and where further leakage will not contaminate drinking or service water. The hole should be at least 6 feet deep, and the shell should be covered to a depth of at least 3 inches with a mixture of bleach powder and sand in equal proportion before the hole is filled with earth. A prominent sign should be erected over the fill prohibiting digging in that vicinity. The burial place of leaking HS shell will be recorded on the official map of the reservation.

2. *Bulk containers.*—In general, shipping and storage containers are too large to be immersed in bleach solution. Whenever a leaking container is discovered, the officer in charge of the magazine will be notified and he will take direct charge of its treatment. The container should be placed so that the leak is elevated. The portion of the container around the leak must be kept wet with bleach solution by flooding, as in the case of dished ends or heads, or by covering with cloths saturated with fresh bleach solution. In some cases, the leak

can be calked after wiping it with a cloth saturated with bleach solution, while in other cases the leak may be stopped by plastering a lump of moist clay over it binding the clay in place with strips of cloth. After leakage has been checked, and if the container is unsatisfactory for further storage, the container will be removed from the building or other storage pending final disposition. Whenever possible the contents of a defective container should be transferred to a serviceable container. This operation must be supervised by a suitably qualified noncommissioned officer. Emptied containers usually will contain from a pint to possibly as much as 5 gallons of HS and from 50 to 100 pounds of sludge consisting principally of sulfur and iron oxide. Unserviceable containers may be disposed of by burial as described under 1 (c) above for leaking shell. To salvage the metal of a ton container, the container may be cut into small pieces, using an acetylene torch, and decontaminating the pieces by fire or bleach solution. If salvage of metal is not desired, pieces of a container cut up by this method may be dropped into deep water or buried in the same manner as described for the disposition of leaking shell. Completely emptied containers may be decontaminated by passing live steam at a pressure of 5 to 15 pounds per square inch through them for a period of 8 hours. The steaming serves to destroy the HS by converting it into a nonvesicant compound. The exhaust steam is dangerous and all drainage from the container during this operation must be collected and treated to destroy any HS present. The sludge remaining in the container may contain some active HS, hence, containers decontaminated by this method alone should not be permitted to come into the hands of personnel unfamiliar with the toxicity of HS.

(d) *Method of removing spilled HS.*—If HS from a leaking shell or container has contaminated the floor or other shell or containers, the spilled HS will be removed by a thorough washing with freshly prepared bleach solution. If HS is spilled on any woodwork, the latter will be removed and burned, as there is no simple treatment to remove HS from woodwork. After washing contaminated metal containers, shell, or a concrete floor with bleach solution, the surface should be covered with dry bleach powder for several days, the bleach then removed, and the washing repeated. Following this, in the case of a concrete floor, all of the contaminated portions will be given a coating of sodium silicate to prevent any traces of HS in the floor from escaping into the air. Doors and windows of the magazine will be kept open until all odor of HS has disappeared.

(e) *Precautions to be taken in case of fire.*—If fire breaks out in any building in which HS is stored, all persons living within two miles down wind from the fire will be notified to vacate until all danger is passed. Members of the fire department and all others fighting the fire will wear complete protective outfits. The immediate area in which any shell or containers have opened during the fire will be considered as contaminated and treated as such. All shell or containers which have been exposed to fire are considered dangerous, and a special inspection is necessary to ascertain their condition.

(f) *Replacement of valves on ton containers.*—Regulations governing replacement of valves on ton containers are contained in TM 3-250.

(2) *Other vesicants.*—In general, the same procedure as stated in (1) above for mustard gas applies in the handling and storage of Lewisite (MI) and other vesicant agents. In the case of Lewisite, alcoholic sodium hydroxide rather than chloride of lime should be used as a neutralizing agent. Plain water also destroys Lewisite, but a solid residue product which is toxic is left.

c. *Chemical warfare ammunition, group B.*—Chemical agents of group B are toxic or irritating, or both. In general, they are highly corrosive. Chlorine and phosgene are con-

fined under high pressure, while the remainder of the group have only slight pressure or practically none. Leaks in containers due to pressure or corrosion are frequent. Many of the substances in this group have a large radius of potential danger. Hence, constant care and watching of containers are necessary. The characteristics of some of the more widely known and used of the chemical agents of this group are as follows:

(1) *Chlorine (Cl).*—(a) *Description and properties.*—Chlorine is a greenish gas at room temperature and atmospheric pressure. It has a characteristic pungent odor, readily tarnishes gold and silver, and is very corrosive to most metals. It exerts an immediate irritating action on the upper respiratory tract, that is, the lining of the nose, the throat, and the upper bronchial tubes, causing intense pain, violent coughing, and a feeling of constriction in the front of the chest. When compressed, the gas condenses to a mobile yellow liquid which boils at about  $-29^{\circ}$  F. ( $-34^{\circ}$  C.) at atmospheric pressure. If the liquid chlorine comes in contact with the skin it will frequently freeze the part it touches, owing to the abstraction of heat by the rapid evaporation of the liquid. Furthermore, very high concentrations of chlorine gas will cause irritation of the skin. At higher temperatures, correspondingly higher pressures are required to condense or liquefy the gas, and a higher pressure is exerted on the container after it is compressed to a liquid. Thus, for example, a cylinder containing liquid chlorine will register a pressure of 54 pounds per square inch at freezing ( $0^{\circ}$  C.), 100 pounds at  $68^{\circ}$  F. ( $20^{\circ}$  C.), and 160 pounds at  $100^{\circ}$  F. ( $38^{\circ}$  C.).

(b) *Storage.*—Chlorine is usually stored in the open in steel ton containers, each container having two valves. When the container is lying in a horizontal position with one valve directly over the other, the well pipe with which the upper valve is connected extends into the vapor space of the upper region and only gaseous chlorine will escape therefrom when the valve is opened or removed (provided the well pipe is intact). Regulations governing the changing of valves and transfer of liquid chlorine from one container to another are contained in TM 3-250.

(c) *Leaking containers.*—Owing to the usually high pressures within chlorine cylinders at normal temperatures, leaking containers are not apt to be a problem because the gas usually will all have escaped before remedial action can be taken. Small gaseous leaks, however, may be discovered before the chlorine has all escaped. In this case the contents of the container should be transferred to another serviceable container as prescribed in existing regulations.

(2) *Phosgene (CG).*—(a) *Description and properties.*—Phosgene is a colorless gas under ordinary temperatures and at atmospheric pressure; its boiling point being about 46° F. (8° C.). Its chemical name is carbonylchloride. Its odor is somewhat like that of green corn or fresh cut hay. Phosgene acts primarily upon the lung tissues proper. High concentrations will cause immediate coughing, difficulty in breathing, pains in the chest, nausea, retching and vomiting, and in extremely high concentrations collapse may be almost immediate. The greatest danger lies in the fact, however, that low concentrations, which are not particularly irritating, may produce delayed serious effects such as difficulty in breathing, rapid pulse, weakness, an accumulation of water in the lungs, cyanosis (blue color), or even death. Phosgene hydrolyzes readily, its hydrolysis products being hydrogen chloride and carbon dioxide.

(b) *Storage.*

1. *Shell.* CG filled shell should be stored in magazines having concrete floors and unrestricted ventilation, particularly near the floor, as described in paragraph 107. All shell, boxed or unboxed, will be piled in stacks with battens separating each tier. Magazines containing phosgene filled shell or containers will be inspected for leaks by some responsible person once a day. The officer in charge of the magazine will inspect not less than once a week.
2. *Bulk containers.*—Phosgene is sometimes stored in steel cylinders or steel one-ton containers. Owing to the extreme casualty action of this agent, the location of this storage should be at a considerable

distance from the nearest habitation. The cylinders or containers should be properly painted and placed on skids so as to permit ready inspection and removal in case of leakage.

(c) *Removal and disposition of leaking munitions.*

1. *Shell.*—All leaking shell will be removed from the magazine and placed down wind from the area pending final disposition. In handling, care must be taken that the liquid CG does not come in contact with clothing or the person. Leaking phosgene shell may be disposed of in any one of the following ways:

- (a) Where leaking CG shell can be dropped into deep water, this is considered a good method of disposal.
- (b) A single leaking shell may be exploded by static firing on the ground surface. The point at which the shell is exploded should be at an unfrequented portion of the post or station and when wind conditions are such that the dispersed gas will not reach personnel.
- (c) A large number of leaking shell will be placed at such a point on the post as not to be a hazard to personnel and kept under guard awaiting orders for final disposition from the office of the Chief of the Chemical Warfare Service. Such shell as are leaking rapidly enough to constitute a menace will be disposed of at once by methods previously described.

2. *Bulk containers.*—Whenever a leaking container is discovered, it should be placed so that the point of leakage is elevated above the liquid in the vessel. If the leak can be stopped easily and without allowing a large amount of the phosgene to escape, this should be done, the container being left in the magazine or other storage place pending disposition. If the leak can not be readily stopped, the container will be moved from the area. All leak-

ing containers will be reported to the officer in charge of the magazine who will direct further operations. Properly repaired containers may be stored in the magazine. Usually, however, it will be necessary to transfer the contents of a leaking container to another container. This should be done under the supervision of the officer in charge of the magazine, in accordance with regulations contained in TM 3-250. (See Appendix.)

(d) *Precautions in case of fire.*—If fire breaks out in any building in which CG is stored, all persons living within two miles down wind from the fire will be notified to vacate until all danger is passed. Members of the fire department and all others fighting the fire are to wear gas masks. All shell or other containers which have been exposed to fire are considered dangerous and a special inspection is necessary to ascertain their condition.

(3) *Diphenylaminechlorarsine (DM).*—(a) *Description and properties.*—DM is a greenish yellow solid having a melting point of 387° F. (195° C.). When breathed in the form of dust or smoke, there results an irritation of the nose, a watery nasal discharge, a splitting headache, irritation of the throat, sneezing, coughing, nausea, and vomiting. The eyes are also intensely irritated. These effects may be immediate or delayed for one-half hour or longer. Exposure to high concentrations will cause complete disability for several hours; however, the effects are usually gone within 12 to 24 hours after exposure. DM is stable when stored in steel containers. It hydrolyzes slowly into hydrogen chloride and DM oxide, the latter being a toxic compound, very injurious if swallowed.

(b) *Storage.*

1. *Candles.*—All DM candles will be packed in boxes and stored in magazines as described in paragraph 106. The boxes will be piled in stacks with battens separating each tier.
2. *Bulk containers.*—DM may be stored in bulk in steel drums or in some cases in wooden barrels. Drums or barrels will be stored in magazines having a concrete floor and ventilators that may be opened from the outside.

(c) *Precautions in case of fire.*—If fire breaks out in any magazine in which DM is stored, all persons living within two miles down wind from the fire will be notified to vacate until all danger is past. All persons fighting the fire will wear gas masks.

(4) *Chloracetophenone (CN).*—(a) *Description and properties.*—CN is a whitish to grayish solid under ordinary conditions, its melting point being about 138° F. (59° C.). Its chemical name is phenylchlormethylketone. The vapors have an odor somewhat like that of apple blossoms and have a powerful lacrimatory effect, but have no permanent effect on the eyes. In high concentrations CN is irritating to the skin. It is toxic but it becomes intolerable in concentrations much below that which is dangerous to life. It has only slight action on metals. It will burn in open air producing slightly irritating fumes, the most of the CN vapor being destroyed by oxidation.

(b) *Storage.*

1. *CN candles and grenades.*—These are burning type munitions and are stored in magazines. They are packed in boxes which are to be piled in stacks with battens separating each tier.
2. *Bulk containers.*—CN burning mixtures are never stored in bulk. Solid CN may be stored in steel, iron, or wooden barrels in magazines.

(5) *Liquid lacrimators (CNS and CNB).*—(a) *Description and properties.*

1. *CNS.*—CNS is a solution of chloracetophenone (CN), in a mixture of chlorpicrin (PS) and chloroform. Its odor is somewhat like that of sticky flypaper. In strong concentrations, it may cause nausea in addition to severe lacrimation. An individual exposed in a closed room to extremely high concentrations for a relatively short period may suffer serious effects such as pains in the chest, abdominal discomfort, vomiting, and an action upon the upper air passages and bronchial tubes somewhat similar to but less violent than that of chlorine. Prolonged exposure, even to a very low concentration,

may cause these effects. CNS has only a slight action on metals.

2. **CNB.**—CNB is a solution of chloracetophenone (CN) in benzene and carbon tetrachloride. This solution should not be permitted to come in contact with the skin or eyes because of the considerable discomfort and possible injury that might result. It has no appreciable action on metals.

(b) *Storage.*—These solutions may be stored in shell, steel cylinders, or drums, or in steel one-ton containers, the manner of storage and other handling of these munitions being similar to those prescribed for phosgene munitions.

(c) *Precautions in case of fire.*—See (2) (d) above.

(6) *Sulfur trioxide-chlorosulfonic acid mixture (FS).*—(a) *Description and properties.*—This mixture is a heavy liquid which fumes strongly in the air and boils at about 149° F. (65° C.). It has an acid odor. It is used solely as a smoke producing agent, and there is no evidence that, in concentrations normally attained in the field, it is harmful to man. Inhalation of the concentrated fumes, however, causes coughing and strangulation, a feeling of constriction around the chest, burning of the nose and throat, and hoarseness. When the mixture comes in contact with moisture, it forms hydrochloric and sulfonic acids, thus making it very corrosive to metals and to fabrics of various kinds. If applied directly to the skin a burning sensation is felt at once and an acid burn follows. FS will not burn.

(b) *Storage.*—This agent may be stored in shell, steel cylinders, or drums, or in steel one-ton containers, the manner of storage and other handling of these munitions being similar to those prescribed for phosgene munitions.

(c) *Precautions in case of fire.*—Because of the large volume of smoke generated, there is an extra hazard of men becoming lost in the building while attempting to fight the flames. Personnel with portable extinguishers should not be permitted in the magazine unless equipped with life lines, as they may have difficulty in finding their way out.

(d) The same precautions which apply to the handling and storage of FS apply also for titanium tetrachloride FM, a

smoke producing material no longer classed as a standard agent.

*d. Chemical ammunition, group C.*—Group C, the spontaneously flammable substances, ignite when exposed to air. White phosphorus (WP) is the principal agent for consideration under this heading and is discussed below.

(1) *White phosphorus (WP).*—(a) *Description and properties.*—WP is a yellowish waxlike substance, melting at 111° F. (44° C.). Its chemical name is yellow phosphorus. It ignites spontaneously on exposure to air and burns giving off a large volume of white smoke. It has the odor of the old style "strike-anywhere" match. The fumes from white phosphorus are extremely poisonous, and continued exposure, even to very low concentrations, will cause necrosis of the bones of the jaw and nose. The smoke is considered harmless. If a burning piece of WP comes in contact with the flesh, it will become embedded and continue to burn, causing great pain and ulcers which are slow to heal. If the quantity of agent or the total area involved is sufficiently great, enough phosphorus may be absorbed to produce serious poisoning.

(b) *Storage.*

1. *Shell.*—WP filled shell will be stored in magazines with concrete floors. The walls of the magazine should be of such a nature that the building can be completely flooded in case of fire. Ideal storage conditions would require a building divided into small watertight compartments to permit complete immersion of munitions within the section or compartment. The more nearly this condition can be approached with watertight walls, watertight partitions, and inside flooding connections, externally operated, the more suitable is the magazine for storage of WP filled munitions.
2. *Bulk containers.*—WP may be stored in concrete tanks or steel drums, the phosphorus itself being immersed in water. Such tanks or drums may be placed either in buildings or in the open, the only precaution necessary being to keep the phosphorus constantly covered with water.

(c) *Removal and disposition of leaking shell.*—The great risk in the case of leaking WP shell is that of fire. This can be successfully combated only by extremely prompt action which includes immersion of the leaking shell in a tub or barrel of water kept in the magazine at all times. Rubber gloves will be worn when handling leaking WP shell. Leaking WP shell should be destroyed by exploding them statically at such a point where fire risk is negligible.

(d) *Precautions to be taken in case of fire.*—Because of the large volume of smoke generated, there is an extra hazard of men becoming lost in the magazine while attempting to fight the fire. Portable extinguishers are of no value in fighting WP fires. WP once extinguished, must be immersed or continually sprayed with water to keep it from starting to burn again. WP filled shell explode with moderate violence when they become heated and scatter fragments of burning phosphorus for a considerable distance. This tends to spread WP fires rapidly, so that, except in magazines provided with means for quick flooding, the fire is likely to be beyond control by the time the fire department arrives. Any shell or containers which have been exposed to fire are considered dangerous and a special inspection will be made to ascertain their condition.

e. *Chemical warfare ammunition, group D.*—Group D readily flammable chemicals, may be mixtures used for incendiary smoke producing purposes, or harassing purposes. These mixtures contain all the elements necessary for combustion and can burn in the absence of air. They are readily ignited and if this occurs, control of the fire is very difficult. In general, these substances are noncorrosive. They are solids and hence, exert no pressure on containers. With the exception of the DM candle, they are nontoxic. The fumes of CN candles are lacrimatory, while HC mixtures produce a slightly irritating smoke.

(1) *Hexachlorethane mixture (HC).*—(a) *Description and properties.*—This mixture consists largely of hexachlorethane and zinc. It is a white powder, readily flammable, which, upon burning, produces a large volume of smoke. If dry, it has no action on metals. It slowly hydrolyzes and in the

presence of sufficient water will ignite spontaneously. The smoke is not toxic, although it does produce a choking sensation.

(b) *Storage.*

1. *Smoke pots.*—HC smoke pots are considered a great fire hazard, hence, will be stored only in fireproof magazines as described in paragraph 107. The smoke pots will be packed in boxes, the latter being piled in stacks with battens separating each tier.
2. *Bulk containers.*—Bulk HC mixture may be stored in steel drums in a magazine.

(c) *Safety precautions.*—In handling and storing HC smoke mixture or HC smoke pots, care must be taken to prevent their coming in contact with water. HC munitions or containers should be piled on rails or sills at least 4 inches high in order to keep them from coming in contact with water on the floor. Frequent inspection will be made of all containers to see that they are not in a leaking condition. The officer in charge of the magazine will inspect at least once each month, paying particular attention to the watertight condition of the roof of the magazine and the possibility of rain or snow being driven in on the munitions through open windows or ventilators.

(d) *Removal and disposition of leaking containers.*—All leaking containers will be removed from the magazine as soon as possible. Leaking candles will be destroyed by burning in a location where fire risk is negligible. The contents of leaking drums will be transferred to another drum and properly sealed.

(e) *Precautions in case of fire.*—A fire in a magazine containing HC munitions is practically impossible to combat except where the magazine can be completely flooded and the munitions immersed. In this case, the large quantity of water used may cool the mixture below its ignition temperature. Men fighting the fire in a magazine will turn water into the building only under the supervision of a person experienced in dealing with HC fires. Carbon dioxide and carbon tetrachloride are of no value in fighting a fire of this material. Containers or munitions filled with HC smoke mixture

that have been exposed to fire will be considered a potential fire hazard. They will be kept under surveillance for a period of 1 week before any of them is declared safe for storage.

■ 105. TYPES AND METHODS OF STORAGE.—*a. General location of magazines and storage areas.*—The storage area for chemical warfare ammunition should be on the prevailing leeward side of a post or station and as far as possible from any inhabited area or building. It is desirable that this distance be at least 2 miles. Care should be taken to see that there are no inhabited buildings on or off this post within 2 miles of such storage area in the direction of the prevailing wind. A storage area should be enclosed in a protective fence which should be secured against trespassers.

*b. Warehouse storage (inert materials).*—(1) Inert chemical warfare materials are usually stored in warehouses. The only items of this group which call for special considerations are those having rubber parts such as the gas mask. The care, handling, packing, and storing of the gas mask is covered in TM 3-205 (none published as TR 1120-35). Deterioration in rubber parts appears to be due principally to its oxidation in contact with air. The rate of oxidation increases with rise in temperature. Excessive moisture is conducive to the formation of molds with consequent deterioration of both rubber and cotton fabrics. Deterioration is reduced to a minimum by storing under cool, dry conditions. Storing in an atmosphere of an inert gas prolongs the life of rubber still further.

(2) Instructions for storage of inert supplies are covered in AR 700-10. Whenever possible, boxed or cased supplies should be stored in two-section stacks to facilitate handling and inventory. Labels and identification marks should be faced toward the aisles. Where lack of space does not allow the use of the two-section stack and larger stacks must be used, headers and stretchers should be used, or the joints should be broken in stacking in order to increase the stability of the stack. Stacks should always be laid out carefully and built square and plumb, for good storage requires that stacks be neat and orderly. Similarly, in preparing a number of packages for shipment, great care should be taken in arrang-

ing and bracing the stacks or piles in the vehicle, car, or boat.

c. *Magazine storage (general)*.—(1) All ammunition should be stored in cool, dry magazines and protected from the direct or reflected rays of the sun. All ventilators and windows of magazines containing explosives, ammunition, or ammunition components should be screened to prevent entrance of sparks. Ordnance practice requires that when the interior temperature of a magazine containing explosives and ammunition exceeds 100° F. (38° C.) for a period of more than 24 consecutive hours, the magazine is to be cooled by wetting the exterior of the building with water or by opening the doors and ventilators after sunset and closing them in the morning (Ordnance Safety Manual No. 7224, par. 49). TM 9-1900 directs that if the temperature in magazines in which smokeless powder is stored exceeds 80° F. continuously for more than 72 hours, consideration should be given to cooling the magazine with water, or to removing its contents. Magazines in which explosives or smokeless powder are habitually stored should be equipped with a maximum and minimum thermometer during a hot spell of summer weather and the thermometer should be read daily or as often as may be necessary. Efforts to control the interior temperature of chemical warfare magazines will be restricted to those containing explosives and smokeless powder. The windows and ventilators of magazines containing chemical agents which are gases at normal temperatures and pressures will be kept open at all times. Stacking should not exceed the height of the eaves. The practice will protect ammunition from excessive temperatures near the roof, and will facilitate fire control in the event of fire. In stacking heavy supplies such as ammunition, consideration must be given to the floor capacity of the structure. Main aisles should be of sufficient width to permit the passage of warehouse trucks moving in opposite directions. Many lateral aisles should be provided to facilitate inventory and inspection.

(2) *Boxed chemical shell*.—Filled chemical shell that are boxed are best stored in two-section stacks. The stack should be so arranged that any one box can be removed without disturbing any other, in order to eliminate leaking shell from

the stack quickly and easily. An illustration of how this may be accomplished is shown in figure 3. Battens are laid on the floor lengthwise of the section. Small 1-inch blocks about 6 inches long are then placed on the battens and the

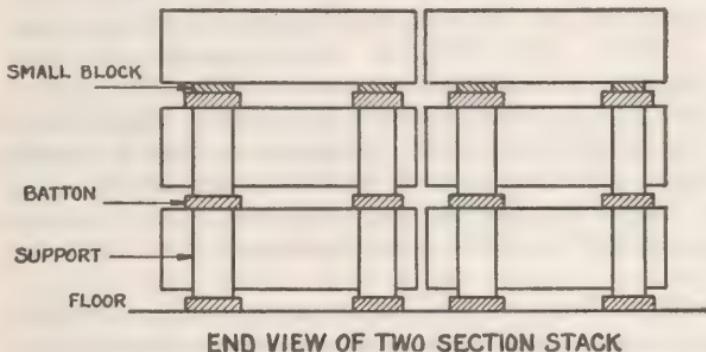
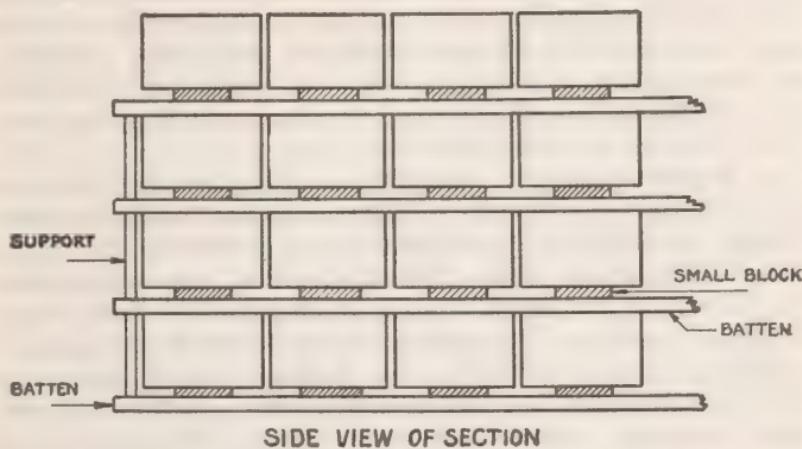


FIGURE 3.—Storage of boxed chemical shell.

boxes are then laid on the blocks. Battens are again laid on the boxes. Supports are placed between battens at the ends of the section. Each tier is built in this manner. If it becomes necessary to remove a single box or case, the small block is knocked out and the box can then be removed without disturbing the rest of the stack.

(3) *Large chemical shell, cylinders, and drums.*—Large filled shell and smaller cylinders up to 300 pounds capacity are stood on end in rows of convenient width so that each shell or container may be easily inspected. There is no objection to placing them in racks, provided such racks can be made so the individual shell can be removed easily. Drums and large cylinders are usually laid on their sides. Sections of narrow gage industrial railway track are useful as foundations for the large cylinders and the drums which weigh from 700 pounds up to 1 ton when filled.

d. *Magazine storage (explosives).*—Magazines for the storage of propelling charges, explosives, chemical mortar ammunition, etc., should be constructed as prescribed in Ordnance Safety Manual No. 7224. There are several types of explosive or ammunition magazines, each for a different class of explosive or powder. The general rule to follow in storing propelling charges, explosives, etc., is that it is forbidden to store together any two substances of such a nature that one may "step up" or explode the other. Thus, detonators must not be stored with high explosives, smokeless powder, or adaptors and bursters. For such propelling charges, fuzes, burster tubes, etc., as are used with chemical warfare ammunition, at least three different magazines are necessary. These "explosives" magazines should be located to conform to the "Quantity-Distance Tables" (TM 9-1900), which recommend the distances at which magazines should be spaced according to the quantities of powder or explosives stored therein. Magazines containing explosives should not be located adjacent to warehouses containing filled chemical shell.

e. *Magazine storage (chemical munitions).*—(1) *Groups A and B magazines.*—Chemical shell are not considered to be an explosive hazard and no limit on quantity has been placed on the storage of this material. However, there are certain restrictions on the storage of this ammunition which must be observed. Chemical agents and chemical munitions of groups A and B are best stored in buildings in which there is the greatest possible ventilation. Since chemical agents are, in general, heavier than air, the ventilation should be unre-

stricted near the floor. The floor should be raised above the ground and should be of concrete. The floors, walls, and ceilings should be treated so as to render them nonabsorbent and impervious to any of the chemical agents. If more effective materials are not available for such treatment, sodium silicate will be used. The use of rubberoid or other floor covering is prohibited. Drains and means of washing down the walls and floors should be provided. All metallic parts of the buildings should be protected from corrosion with corrosion-resistive paint.

(2) *Groups C and D magazines.*—Chemical agents and chemical munitions of groups C and D require sound, weather-tight, fireproof storage buildings. Ample ventilation should be provided and it should be so arranged that in case of an emergency, the ventilators may be opened from the outside. A small quantity of water may ignite some of the group D munitions, hence, facilities for completely flooding the buildings should be provided. The floors should be of concrete and in magazines for group D munitions should slope at least 1 inch in every 20 feet in order to drain off water. At least one scupper of standard size (4-inch by 4-inch) and made of noncorrosive metal should be provided for each 1,000 square feet of floor space.

f. *Open storage.*—In any temporary emergency necessitating storage outdoors overnight or for a longer period, filled chemical shell and inert material should be covered with a tarpaulin in such a manner as to protect the materials from the direct rays of the sun and from rainfall. These materials should be piled in such a way as to permit free circulation of air. The piles and stacks should be built on a foundation so that the lower tier of packages will not rest on the ground.

Large tanks and containers for bulk chemical agents are often stored in the open over long periods. These tanks and large cylinders should be raised off the ground so as to permit a free circulation of air. The valves should be well greased at all times. The cylinders should be painted frequently to protect them from corrosion, which causes the majority of the leaks in cylinders. The use of aluminum paint is recommended as it has been found to resist not only corrosion, but also the heating effect of the direct rays of the sun.

■ 106. INSTRUCTIONS FOR CARE OF MAGAZINES AND GROUNDS.—*a. General.*—General instructions for the care of magazines used for storage of munitions and of the grounds around such magazines are prescribed in TM 9-1900. Protection against fire is of paramount importance. In storing munitions and other supplies, a passageway not less than 2 feet wide for use in case of fire should be left adjacent to the walls and partitions. Grass, weeds, and undergrowth which may become a fire hazard, should be controlled by mowing, plowing, cutting, or in some cases by burning. Burning should not be permitted within the 50-foot space maintained around the magazine, and piles of debris, weeds, etc., should not be burned within a 200-foot radius.

*b. Rules for magazines and grounds.*—Signs setting forth the special rules and instructions to be observed by all concerned may be obtained through proper channels. These signs are to be posted on or near each door of the magazine in accordance with instructions on the signs furnished. The wording of these signs is as shown in the appendix.

■ 107. ORGANIZATION AND ADMINISTRATION OF MAGAZINES.—*a. Magazine personnel.*—(1) *General.*—The personnel employed in handling chemical warfare munitions or explosives should be specially trained in their work. They should be in charge of a competent experienced foreman or superintendent. Inexperienced workmen or laborers should not be permitted to work around the magazine, except when accompanied by experienced munitions and toxic-gas handlers who are placed in charge. All employees should be trained in the use of gas masks and protective clothing and appliances. All personnel will report for work each day with clean-shaven faces, as otherwise a gastight fit of the gas mask facepiece cannot be assured. When handling any considerable amounts of chemical agents such as FM or FS, which, if spilled, may cause burns, they should wear their trouser legs over their boot tops to prevent the agent from running down into their boots and also to facilitate removal of their trousers in case of accident. They should be required to know the principles of first-aid equipment. They must be taught how to recognize an escaping chemical agent either by its odor or other simple indica-

tions and how to find and identify the leaking container or shell. They should be required to handle all shell and containers, whether boxed or otherwise, with the proper tools. They must be made to realize at all times the hazards of the various munitions with which they work. They will be required to obey all rules implicitly and will be checked frequently to see that they do. They should be taught to wash their hands with soap and water after they have been working in magazines containing chemical agents, particularly so before eating. They will not be permitted to eat their lunches in the magazines.

(2) *Magazine foreman.*—Upon the opening of a magazine, or upon first entering a magazine when work is to be done therein, the foreman or magazine superintendent must be present. He will carefully test the air for odors or indications of escaping chemical agents. The magazine foreman or superintendent or officer in charge will accompany all visitors to magazines, and will see that all are properly equipped with the necessary protective equipment.

b. *Equipment and supplies.*—(1) *General warehouse equipment.*—(a) *Transportation.*—General warehouse equipment such as trucks, roller conveyors, dollies, etc., should be kept in a part of the warehouse or magazine specially set aside for that purpose, where contamination is not likely to occur when there is a leak or spill. Only enough of this type of equipment should be held in each warehouse to meet ordinary handling needs. While it may not always be feasible on account of magazines being widely separated, it is preferable to store these materials at some other point than in the warehouse itself. General warehouse supplies should never be stored in a magazine containing chemical agents.

(b) *Tools.*—Tool boxes for such common tools as are required should be provided at a central location. Tools should never be left or stored in a magazine. After tools or special wrenches have been used around leaking chemical agents, they should be thoroughly washed with kerosene, rinsed with water, and then dried.

(2) *Fire equipment.*—The fire equipment for warehouses used for storage of inert materials should be of the standard

type for such warehouses, such as fire buckets and chemical extinguishers. In general, magazines used for the storage of explosives and powders and of chemical ammunition of groups A and B should have the same kind of fire equipment. Magazines used for storage of group C substances should have drowning tanks or vats located in close proximity to the stacks of material, and should be equipped with low-pressure lines and hose. Warehouses used for the storage of group D substances should be provided with auxiliary fire-fighting equipment, such as soda and acid or antifreeze extinguishers, hose lines, water pails, and fire axes. Where the buildings are not heated, the antifreeze extinguishers should be provided in preference to the soda and acid type. In cold weather, and in unheated buildings, drowning tanks and pails containing water will be treated with calcium chloride ( $\text{CaCl}_2$ ). If the tanks and pails are of iron they should be painted with an acid-resistive paint. The following table will govern the amount of calcium chloride to be used (based on 75 percent granulated calcium chloride). To each  $2\frac{1}{2}$  gallons of chloride solution 1 tablespoonful of lime should be added to prevent corrosion.

Approximate freezing temperature, ° F.	Water		$\text{CaCl}_2$		Specific gravity	Baumé
	Gallons	Quart	Pounds	Ounces		
10.....	2	1	5	-----	1.139	17.7
0.....	2	1	6	4	1.175	21.6
-10.....	2	-----	7	6	1.205	24.7
-20.....	2	-----	9	2	1.246	28.6
-40.....	2	-----	10	-----	1.263	30.2

All fire equipment and apparatus should be inspected at least once a week. For the care of certain chemical extinguishers during winter weather, see AR 30-1580. If an incendiary munition of the solid or liquid oil type should in the future be adopted, some suitable equipment for fighting oil fires

should be maintained at all times adjacent to magazines in which this class of material is stored.

(3) *Special equipment and supplies.*—All officers, men, firemen, or other permanent personnel whose duties may require their presence in the magazine area, will be provided with and instructed in the use of protective equipment. Each person will have the following equipment assigned to him. He must know where it is to be found.

- 1 Gas mask, fitted.
- 1 Protective suit.
- 1 Pair protective boots or rubber boots.
- 2 Pairs protective gloves or protective mittens.

These articles should be stored in a central location, quickly available to all employees. The officer in charge of each organization in which personnel is provided with protective equipment must inspect this equipment at least once each week. In magazines containing group A chemical agents, large iron tanks of sufficient size to readily contain one large shell or container should be provided. These tanks are for use for bleach-solution baths. Grade A calcium hypochlorite, sometimes known under the trade name HTH (high-test hypochlorite), containing not less than 62 percent available chlorine, in quantities of 50 pounds for each ton of HS and up to a total of 1 barrel of HTH, should be held in storage at all times. If HTH is not available grade B calcium hypochlorite (commercial bleach or chloride of lime), containing not less than 35 percent available chlorine, in quantities of 100 pounds for each ton of HS and up to a total of 2 barrels of bleach, should be held in storage at all times. Wherever the word "bleach" is used in this text, grade A calcium hypochlorite is meant, unless it is not available, when commercial bleach will be used. *Dry* bleach must not be used for destroying liquid HS, as it will cause the mustard to ignite. It should always be mixed to a paste with water before applying it to liquid HS. A sufficient quantity of heavy rubber gloves (gauntlet type) and rubber boots should be provided for all personnel required to work in magazines for the storage of group C chemical agents. These supplies should be stored adjacent to magazines for this type of chemical agents, and in such a way as to be readily accessible.

(4) *First-aid equipment.*—First-aid equipment for use around magazines containing group A, B, C, and D materials should include—

- 1 First-aid chemical kit MI.
- 2 Stretchers (or litters).
- 6 Woolen blankets.
- 3 Buckets (or pails) of approximately 14-quart capacity each.
- 2 Sponges.
- 6 Hand scrubbing brushes, medium size.

All this equipment should be located centrally to all magazines used for storage of chemical agents and should be known as the "First-Aid Station." In the first-aid station there should be a bathtub for severe cases of WP burns and a shower (for first aid) with hot and cold running water. Where the magazines containing chemical agents are widely scattered, there should be a separate first-aid station for each magazine or group of magazines situated close together. In the first-aid station certain supplies and medicines should be kept for cases of emergency. These supplies should, in addition to those mentioned above, include—

- 1 gallon kerosene.
- 3 dozen flannel cloths (about 1 foot square).
- 1 syringe (or douche cup).
- 1 nasal douche.
- 1 pint saturated solution boric acid.
- 1 pint, 1 percent solution of sodium bicarbonate.
- 1 8-ounce bottle of chloroform, U.S.P., to which is added a few drops of ammonia.
- 1 5-gallon carboy of a saturated solution of sodium hydroxide (caustic soda) in grain alcohol (95 percent). This solution may be made up more readily by dissolving 5 parts of solid sodium hydroxide in an equal weight of water and then pouring this into 100 parts of alcohol and stirring. To make up 5 gallons, dissolve 2 pounds sodium hydroxide in 1 quart water and pour into 4.7 gallons alcohol. This carboy will be kept tightly stoppered.
- 2 1-pound cans lye.

- 1 5-gallon carboy of a 5 percent copper sulphate solution.
- 1 pint solution made in the following proportions: 95 cc. 1 percent salt solution (NaCl), 5 cc. 95 percent grain alcohol (U.S.P.), and 1 drop of ammonia.
- 1 pound vaseline (petroleum jelly).
- 2 quarts alcoholic sodium bicarbonate solution. 100 grams NaHCO<sub>3</sub> dissolved in 500 cc. water, 500 cc. grain alcohol (95 percent) added. Shake before using.

1 quart tincture of green soap, U.S.P.

The responsible officer will provide for monthly inspection of first-aid kits to see that they are maintained in good condition and ready for immediate use.

c. *Reports required.*—(1) *For material used.*—For all items of chemical warfare munitions, including chemicals, used during the month and in which malfunctioning occurred, a report in duplicate will be forwarded to the Chief of the Chemical Warfare Service showing the circumstances of the malfunctioning. This report will be submitted by each officer of the Chemical Warfare Service under whose direction the material was used. The cause of the defect will be investigated and all necessary precautions will be taken to prevent accidents. Duds containing toxic or explosive materials will be disposed of under existing regulations. Reports of dangerous malfunctioning will be made by telegraph or radio. In case no malfunctioning of material occurred during the month, a statement to that effect will be made in the monthly report of activities. Results of the investigations of defects will be included in the report which, in addition to a description of the circumstances, will cover—

- (a) Name and lot number of each defective article.
- (b) Total number tested or used.
- (c) Number found defective.
- (d) Nature of defect.
- (e) Analysis of failures including conditions of local storage, effects of transportation, lack of skill of operators, apparent deterioration, other apparent causes of failure.

(f) Recommendation as to improvement of munition for particular use (specific).

(2) *For material stored.*—When leakers occur or damaged ammunition is found, the cause of the defect will be investigated under the direction of the chemical office, all necessary precautions being taken to avoid accidents. A report of these investigations will be forwarded through command channels to the Chief of the Chemical Warfare Service. The report should, in general, contain the following data:

- (a) Lot number.
- (b) Date discovered.
- (c) Disposition; or in the event that immediate disposition is not required, recommendation for such disposition.
- (d) Detailed information as to the nature of the leak and whether it appeared to have been caused by defective material or improper handling.

In case there is grave danger and the quantities of munitions are large, the report should be made by telegraph. Where large quantities of munitions are involved, the disposition will, if practical, be by order from the office of Chief of the Chemical Warfare Service. If it not feasible to await such order, destruction will be by methods decided upon by the responsible officer. The methods employed will be predicated on properties of the fillings as stated herein, but need not follow literally methods of destruction specified.

(3) *Injuries.*—In the event of injury to any personnel in connection with the handling of chemical munitions, one copy of the report of injury required by existing regulations will be forwarded to the Chief of the Chemical Warfare Service, through channels.

### SECTION III

#### SHIPMENT

■ 108. **GENERAL.**—Too much emphasis cannot be laid on the importance of taking every precaution to avoid accident in shipping hazardous chemical warfare materials. Personnel employed at the point of storage of such material are usually impressed with the proper way of avoiding accidents and they

have the necessary equipment to handle any emergency. During shipment the materials will be handled by personnel who are usually uninformed as to the probable danger of an escaping chemical and entirely untrained as to what must be done in case of an emergency. The materials themselves are subjected to unavoidable jolts and jarring which seldom, if ever, occur in storage; hence leaks or accidents are much more likely to occur. To safeguard personnel, other supplies and equipment, all possible contingencies should be considered before making a shipment. Various rules and regulations have been published to insure this, and when they are rigidly adhered to accidents are not likely to occur.

■ **109. PRECAUTIONS TO BE TAKEN IN SHIPPING DANGEROUS ARTICLES.**—In shipping dangerous chemicals, explosives, or chemical munitions, the main points to observe are as follows:

- a. Make sure that the shipment of the material in question is not forbidden by regulations of the War Department or the Interstate Commerce Commission.
- b. See that the material is contained in proper shipping containers and that it is properly boxed; see that containers have been tested in accordance with specifications.
- c. See that the total quantity shipped is within the specified maximum limits for weight or contents.
- d. See that the containers are stowed or stacked and braced in the car, vessel, motor truck, or wagon with the greatest of care.
- e. See that the boxes or containers are properly marked and labeled.
- f. See that the bills of lading properly describe the materials according to the name and classification as laid down by the Interstate Commerce Commission.
- g. See that the railway car, boat, motor truck, or wagon is properly placarded and marked with the proper danger signals.
- h. Explosives that will "set-up" one another must not be loaded or shipped in the same vehicle; neither must they be stowed in the same boat, magazine, or section when aboard ship.

■ 110. SHIPPING CONTAINERS.—*a.* Shipping containers for hazardous materials may be cannon shell, bombs, grenade bodies, cylinders, drums, steel barrels, metal cans, glass jars, bottles, and sometimes tank cars. Shell and other containers of less than 90 pounds in total weight are boxed in strong boxes of approved construction. The specifications for all containers, except military shell, bombs, grenades, etc., are published in Interstate Commerce Commission Regulations for Transportation of Explosives and Other Dangerous Articles by Freight and Express or as Baggage.

*b.* Military explosives and chemical munitions are packed according to United States Army specifications and drawings. The methods not only meet military requirements and protect the articles from damage in transit, but they also comply with Interstate Commerce Commission regulations.

■ 111. MARKING.—*a.* All explosives, chemical warfare ammunition, and other dangerous articles offered for shipment on a common carrier will be marked to comply with Interstate Commerce Commission regulations.

*b.* Military explosives and ammunition will, in addition, be marked in accordance with U. S. Army specifications. The markings are primarily for the identification of the material from a military standpoint, but they also comply with Interstate Commerce Commission regulations.

■ 112. STOWING, LOADING, AND BRACING.—The stowing, loading, and bracing of hazardous materials are highly important. Packages must be braced so that shifting will not occur. Conservation of cargo space is also an important element. Some of the containers are shaped so that both of these demands are difficult to meet, but by following approved loading and stowing methods satisfactory results can be accomplished. In general, boxes should be stowed on the most stable side and arranged in such a manner that the joints are staggered at each course. The end of each tier of boxes should be braced with a strong well-constructed wooden brace, well nailed to the floor and the sides of the car or other conveyance, but not to the boxes themselves. Each tier should be staggered. Barrels or large drums stow and brace best when standing on their ends. Cylinders and small kegs stow

and brace best on their sides. Cylindrical containers stow with the least play and with the greatest economy of space when the cylinders of the second tier or row are placed in the cantline of the first. (The cantline is the space between two cylinders when placed side by side.) This method really amounts to staggering the articles. Flanged drums, when stored on their sides, are placed so that the flanges are offset.

■ 113. METHODS OF TRANSPORTATION.—*a.* The three general ways of transporting dangerous articles or substances are—

- (1) By motor trucks or animal drawn vehicles.
- (2) By railroad.
- (3) By water (boats, barges and lighters, and steamers).

*b.* Shipments may be made in any one or a combination of any or all of these ways. Hence, it is important that uniform methods be employed in all cases and that uniform precautions be taken. No matter how short the distance of the shipment may be, the same care should be taken as if it were to be made a great distance.

■ 114. TRANSPORTATION BY MOTOR TRUCKS OR ANIMAL-DRAWN VEHICLES.—*a.* Interstate Commerce Commission regulations, insofar as applicable, govern shipments of explosives and ammunition in motor trucks. Nearly all States, cities, towns, and villages also have laws governing the transportation of explosives and other dangerous articles within their jurisdiction. When making shipments of explosives and ammunition by motor, consult with local civil authorities of the cities and towns through which the explosives and ammunition are to be transported and strictly observe their rules and regulations for the transportation of explosives and ammunition. Obtain their recommendations as to the best route to follow, so as to avoid congested areas.

*b.* Take every precaution against fire. Inspect trucks daily to see that electric wiring, lights, brakes, gasoline tanks, and lines are in good working order; clean the engine daily of dust and oil, and make sure that the engine pan is free from accumulations of dirt and greases. Watch carefully the splash of oil or grease from the universal joint, transmission, or other moving parts onto the underside of footboards or body of the car and clean thoroughly after each long trip

or day's work. Repair leaking gasoline tanks or lines immediately; keep lighted cigarettes, pipes, and open lights away from the vicinity when filling gasoline tank and loading of explosives. Do not permit smoking on or near the truck or the carrying of matches in pockets. Where necessary use safety matches and keep them in a metal container in the tool box. Prohibit the use of strike-anywhere matches. Keep only the least possible amount of waste in the truck and keep oily and clean waste separate. Do not allow trash to accumulate in the tool box. Provide all trucks with at least one properly filled fire extinguisher, a box containing at least 3 cubic feet of dry sand, and a suitable shovel. Instruct all drivers and other employees as to the best method of extinguishing gasoline fires with Pyrene and sand and impress them with the fact that in nearly all cases there is time to extinguish a fire, as it takes an appreciable time to heat ammunition to the point where it will explode.

c. When explosives and chemical ammunition are being transported by a convoy of trucks, see that the trucks do not become widely separated and that a safe distance is maintained between trucks so as to avoid danger of collision. Stop the convoy once each hour during the trip and inspect each truck load. Do not stop within or close to the limits of cities, towns, or municipalities, and in driving through towns and cities keep away from congested streets as much as possible. Drive at a moderate speed, always, have truck under control, and be careful not to collide with or allow others to collide with you. Come to a full stop at railroad crossings. Permit no unauthorized person to ride on trucks. If a truck catches on fire, the other trucks will proceed to a safe distance out of the zone of danger in case of an explosion, and guards will be posted at a distance of several hundred yards on each side of the truck to stop all traffic. If a truck breaks down and it cannot be towed to its destination by one of the other trucks, leave a guard of two men and notify the post to which the convoy is proceeding, so that a truck can be dispatched at once with loading personnel to relieve the disabled truck of its load.

d. Do not transport fuzes or other detonating agents with other explosives. When explosives are to be carried, lay

boards or the equivalent over the iron strips in the floor of truck body before placing the explosives. See that the load is well braced and stayed and that tarpaulins are available to protect the load from the weather or from sparks from passing locomotives, etc. Do not unload or pile explosives and chemical ammunition immediately back of the exhaust.

■ 115. TRANSPORTATION BY RAILROAD.—*a.* Interstate Commerce Commission regulations which govern the transportation of explosives and other dangerous articles by rail are essentially safety regulations and describe in detail how such shipments will be handled, loaded, braced, stayed, and placarded. These recommendations, although for commercial explosives and other dangerous articles, can readily be adapted to military explosives and ammunition and will be followed when a method such as that set forth in United States Army Specifications No. 50-21-4 is not prescribed.

*b.* TM 3-250 contains regulations governing the handling and shipment of tank cars and 1-ton containers of chemical agents.

■ 116. TRANSPORTATION BY WATER (BOATS, BARGES AND LIGHTERS, AND STEAMERS).—*a.* Until Interstate Commerce Commission regulations for water shipments become available, such shipments will be made in accordance with the Interstate Commerce Commission regulations governing rail shipments and the port and harbor regulations of the various cities and states effected. Shipments overseas will be made in accordance with the regulations of the carrier, usually the Quartermaster Corps (AR 30-1270) or the Navy Department.

*b.* When making shipments of explosives and ammunition by water, study the local port regulations regarding the handling of explosives therein and comply with the regulations for tonnage, lights, open fires, stoves, mixed loads, flags, anchors, etc. When chartering equipment for shipments have the equipment passed upon by port authorities before accepting it for use. During loading see that the safety regulations for open fires, stoves, gasoline, matches, and smoking are strictly complied with; that decks, runways, and docks are free from dirt, rubbish, and spilled explosives; and that personnel handle explosives and chemical ammunition with care.

so as to avoid danger and damage to the shipment. If the loading is not completed during the day, see that proper precautions are taken to guard and protect the shipment against fire and that a sufficient crew is left in charge to handle the boat in case of emergency. Do not leave any explosives or ammunition on a dock or elsewhere unless delivery is made to authorized persons or explosives left under proper guard. Explosives and ammunition must not be left on board boats overnight unless such action is imperative incident to their transportation. Lighters should not be tied up to that part of a vessel or dock where the fireroom or boiler is located. Always keep explosives as far away from engine and boiler room as possible.

## APPENDIX

### LIST OF SIGNS

#### GENERAL RULES TO BE POSTED IN ALL MAGAZINES CONTAINING CHEMICAL WARFARE MUNITIONS

##### **READ!**

##### **REMEMBER!**

1. Handle chemical warfare ammunition carefully.
2. Store ammunition of each group separately.
3. Propellants, explosives, fuzes, primers, boosters, and blasting caps must not be stored with chemical warfare munitions but must be stored in separate buildings in accordance with ordnance regulations.
4. Keep complete lots in separate piles.
5. Issue oldest lots first.
6. Inspect stocks daily for "leakers" and unusual conditions, and report "leakers" damaged packages, or other unusual circumstances to depot chemical officer at once.
7. Pile containers on battens so that individual containers may be readily inspected, or easily removed if damaged or leaking.
8. See that signs are posted on outside of magazine describing group contained therein.
9. Do not open, repack, or repair containers in or near this magazine.
10. No smoking allowed.
11. Use of open flame lights or burning lanterns or lamps is forbidden. If artificial light is needed, use electric torch, flashlight, or electric light.
12. Keep this magazine neat and clean. Clean up thoroughly after working in building.
13. Tools must not be kept in this magazine.
14. Inspect all protective equipment at intervals of at least once a week.

CHEMICAL WARFARE SERVICE FIELD MANUAL

15. Know the location of all equipment and first-aid supplies.
16. Handle packages or containers only with authorized equipment.
17. Allow no unauthorized person to be admitted to this magazine.
18. Keep the ground around this magazine clear of debris, weeds, grass, underbrush, and dead trees for the required distances.
19. Depot chemical officers will see that a copy of these rules is posted conspicuously at each door of magazines.

**STORAGE AND CARE OF EXPLOSIVES**

**GENERAL INSTRUCTIONS**

1. Always handle explosives and ammunition carefully.
2. Remove dirt, grit, and foreign materials from containers and ammunition before placing in storage.
3. Do not store explosives and ammunition in damaged containers.
4. Keep all containers in magazine effectively closed so that the contents cannot be handled, examined, or removed.
5. Store each lot separately. Make the piles stable. Provide for a free circulation of air to all parts of the pile. Raise containers and ammunition off the floor by dunnage.
6. Do not open, repair, pack, or repack containers in or within 100 feet of magazine, except as permitted by Ordnance Safety Manual No. 7224.
7. Do not keep empty containers, tools, or other materials in magazine.
8. Absolute cleanliness and order must be maintained.
9. Use only electric lantern and flashlights approved by the Ordnance Safety Manual.
10. Do not smoke or bring matches into magazine.
11. Do not allow unauthorized persons in or near magazine.
12. Keep magazine spark tight, with ventilators well screened, and no openings around doors or foundations.
13. Keep doors securely locked. Close doors while cars are being placed or while engine, speeder, or tractor is passing, or in immediate vicinity.

SUPPLY AND FIELD SERVICE

14. Keep the ground around this magazine free from any inflammable material.
15. Wear safety shoes or rubbers if black powder is stored in magazine.
16. Post conspicuously one or more copies of these rules in magazine.
17. See Ordnance Safety Manual No. 7224 for detailed instructions.

**SPECIAL RULES FOR GROUP A—CHEMICAL WARFARE MUNITIONS**

1. This magazine contains persistent vesicants.
2. Keep this magazine well ventilated at all times.
3. Qualified responsible employee, foreman, or officer in charge must be present on opening of magazine.
4. Visitors must be accompanied by qualified depot personnel.
5. On entering this magazine test for escaping chemical agents.
6. If odor is present protective clothing and equipment must be worn.
7. Learn first-aid treatment for vesicants in case of accident.
8. Wash hands thoroughly with soap and water after handling materials in this magazine.
9. Handle "leakers" in accordance with existing regulations.
10. Use of rubberoid or floor covering is prohibited.
11. See that special equipment and safety supplies are available.
12. Remember precautions to be taken in case of fire.
13. A copy of these rules must be placed in a conspicuous place on the door of each magazine containing Group A munitions.

**SPECIAL RULES FOR GROUP B—CHEMICAL WARFARE MUNITIONS**

1. This magazine contains toxics, irritants, and smokes.
2. Keep this magazine well ventilated at all times.
3. On entering this magazine test for escaping chemical agents.
4. Carry protective equipment when entering this magazine.

CHEMICAL WARFARE SERVICE FIELD MANUAL

5. Learn first-aid treatment for irritants in case of accident.
6. Wash hands thoroughly with soap and water after handling boxes or containers.
7. A qualified responsible employee, foreman, or officer in charge must be present on opening of magazine.
8. Visitors must be accompanied by qualified depot personnel.
9. Handle "leakers" in accordance with existing regulations.
10. Use of rubberoid or floor covering is prohibited.
11. See that the required special equipment is readily available.
12. Remember precautions to be taken in case of fire.
13. A copy of these rules must be placed in a conspicuous place on the door of each magazine containing Group B munitions.

SPECIAL RULES FOR GROUP C—CHEMICAL WARFARE MUNITIONS

1. This magazine contains spontaneously flammable chemical munitions.
2. This magazine must be kept securely locked.
3. Visitors must be accompanied by qualified depot personnel.
4. Handle "leakers" in accordance with existing regulations.
5. Learn first-aid treatment for phosphorus burns in case of accident.
6. See that drowning tank is filled with water in this magazine.
7. A copy of these rules must be placed in a conspicuous place on the door of each magazine containing Group C munitions.

SPECIAL RULES FOR GROUP D—CHEMICAL WARFARE MUNITIONS

1. This magazine contains incendiary and readily flammable munitions.
2. Visitors must be accompanied by qualified depot personnel.
3. Handle "leakers" in accordance with existing regulations.

SUPPLY AND FIELD SERVICE

4. Learn first-aid treatment for burns in case of accident.
5. See that special fire-fighting equipment for chemical fires is available and in good condition. It is to be inspected at frequent intervals.
6. Keep stocks in this magazine dry.
7. Roof must be in repair at all times.
8. Do not use water in or near this building.
9. A copy of these rules must be placed in a conspicuous place on the door of each magazine containing Group D munitions.



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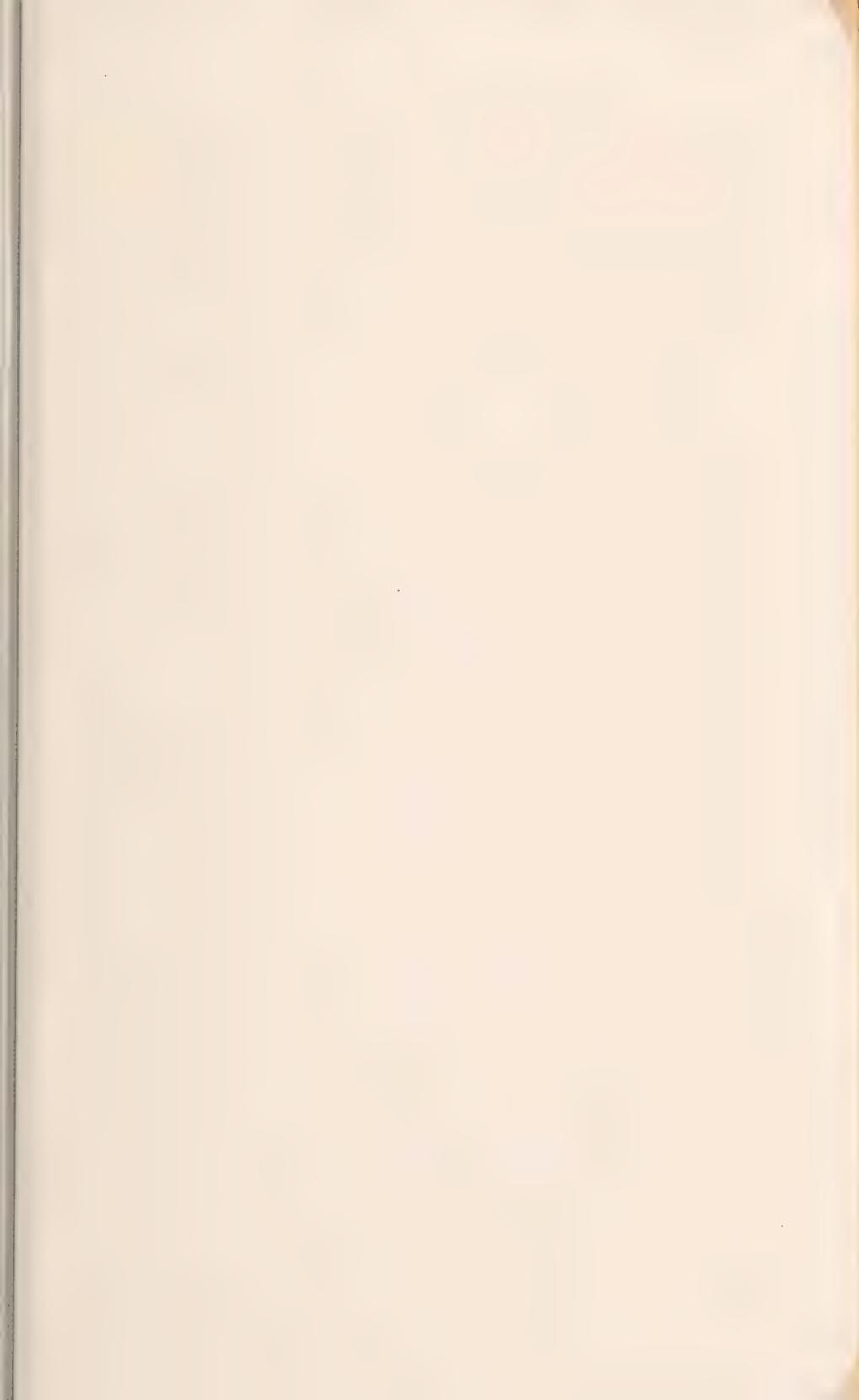
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# CHEMICAL WARFARE SERVICE

## FIELD MANUAL

### SUPPLY AND FIELD SERVICE

#### CHANGES }

No. 1 }

WAR DEPARTMENT,  
WASHINGTON, October 29, 1941.

FM 3-15, February 17, 1941, is changed as follows:

■ 6. SUPPLIES.

\* \* \* \* \*

e. The above classification which applies to military supplies in general should not be confused with the separate classification used within supply arms and services in regard to the supplies furnished by them. For instance, as shown in the Chemical Warfare Service Supply Catalog, all chemical warfare supplies are divided in the service classification into classes I to XIII, and of these, war chemicals (class II CWS) are further classified in groups A, B, and C.

[A. G. 062.11 (9-22-41).] (C 1, Oct. 29, 1941.)

■ 7. PROCUREMENT.—Procurement is the administrative process of acquiring supplies or services. It is effected by manufacture or purchase, requisition, establishment of credits, or a system of automatic supply.

[A. G. 062.11 (9-22-41).] (C 1, Oct. 29, 1941.)

■ 25. TRAINS.

\* \* \* \* \*

b. *Daily train.*—The term daily train applies to the train arriving daily at a railhead with class I supplies for the troops which the railhead serves. (A daily train may consist of one or more unit sections, each unit section being for a designated division or other unit or group of units of approximately the same number of men as a division.)

[A. G. 062.11 (9-22-41).] (C 1, Oct. 29, 1941.)

■ 31. SUPPLY PROCEDURE.

\* \* \* \* \*

421315°—41

## FIELD MANUAL

### *a. Class II supplies.*

\* \* \* \* \*

(2) When credits are established in army depots for divisions and corps troops, calls are made as required direct on the proper army depot by the division or corps supply service concerned. Division and corps transportation is then sent to the depot for the desired supplies. If no credits are established, supply is on a requisition basis. In this case, supply officers submit approved requisitions direct to the proper supply service of the next higher echelon in the chain of supply, where the requisitions are filled from available stocks.

\* \* \* \* \*

[A. G. 062.11 (9-22-41).] (C 1, Oct. 29, 1941.)

### ■ 36. ORGANIZATION.

\* \* \* \* \*

(See chart on following page.)

■ 39. CHEMICAL OFFICER, COMMUNICATIONS ZONE.—*a.* The chemical officer on the staff of the communications zone commander is charged with the following responsibilities:

\* \* \* \* \*

(4) Recommendations for the appointment of commanders of chemical warfare sections of general depots, and appointment of commanders of chemical warfare depots.

[A. G. 062.11 (9-22-41).] (C 1, Oct. 29, 1941.)

■ 48. FUNCTIONS.—The function of the chemical depot company, as its name indicates, is the operation of a chemical warfare supply depot. This involves the reception, storage, surveillance, issue, filling of certain chemical munitions, and shipment of chemical warfare supplies. The company \* \* \* supply sections of general depots.

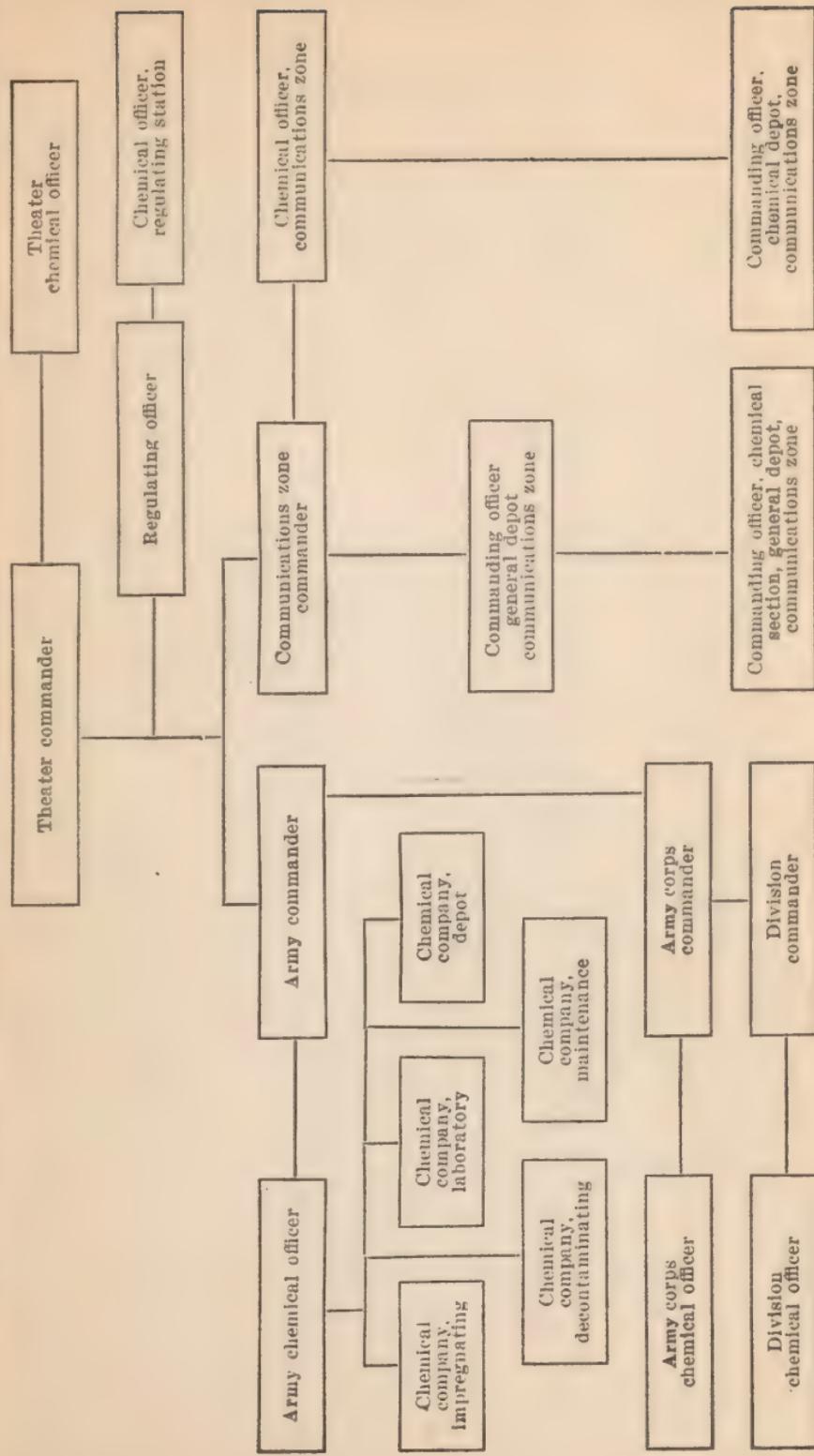
[A. G. 062.11 (9-22-41).] (C 1, Oct. 29, 1941.)

### ■ 54. CHEMICAL AMMUNITION.

\* \* \* \* \*

*d.* (1) Chemical depot companies will operate such chemical filling or refilling establishments as may be necessary

DISTRIBUTION OF SERVICE AGENCIES, CHEMICAL WARFARE SERVICE, THEATER OF OPERATIONS



## CHEMICAL WARFARE SERVICE

in the field for the provision of certain munitions such as chemical land mines and portable chemical cylinders.

(2) Chemical filling operations in the field may vary considerably as to the location of establishments and character of the work performed. In some cases it may be feasible and desirable to carry out this work in the army service area. In others, circumstances may dictate confining such activities to the communications zone. Should the nature of the campaign necessitate extensive work of this character, specially organized and trained munitions filling units will be required.

[A. G. 062.11 (9-22-41).] (C 1, Oct. 29, 1941.)

■ 56½. CHEMICAL FILLING OPERATIONS.—*a.* In warfare in which toxic gas is employed, certain chemical munition filling operations must be carried out in the field. These operations involve the filling or refilling of portable chemical cylinders and the filling of chemical land mines. The light construction of the containers makes it undesirable, for safety purposes, to stock large quantities of filled mines in rear depots or ship them over long distances. In addition to these filling operations, it may at times be necessary to fill Livens projector shell in the field.

*b.* The equipment required for chemical filling work is considerable and may involve certain refrigeration apparatus necessary for keeping the chemical in a proper state for reasonably safe handling during the filling process. It is probable that in each case where such operations are required, special arrangements will have to be made including the provision of experienced technicians. At times, it may be practicable to carry on this work in the army service area. In this case, the chemical depot company of the army will be charged either with the work or with furnishing men to assist specially qualified technicians sent from the communications zone. Generally it will be desirable to carry out such chemical filling operations in the communications zone, providing specially trained detachments for the purpose.

[A. G. 062.11 (9-22-41).] (C 1, Oct. 29, 1941.)

## FIELD MANUAL

### ■ 57. SCOPE AND RESPONSIBILITY.—*a.* Maintenance of chemical warfare equipment \* \* \* are as follows:

\* \* \* \* \*

(2) Repair and rehabilitation of weapons used by chemical combat troops and the Air Corps.

\* \* \* \* \*

(4) Rescinded.

*b.* Rescinded

Subparagraph *c* is relettered *b*.

[A. G. 062.11 (9-22-41).] (C 1, Oct. 29, 1941.)

### ■ 60. SALVAGE SERVICE.

\* \* \* \* \*

*c.* The removal of contaminated clothing from salvage dumps and delivery to the chemical impregnating company for decontamination and return to the quartermaster are duties charged to the Chemical Warfare Service.

[A. G. 062.11 (9-22-41).] (C 1, Oct. 29, 1941.)

### ■ 61. CHEMICAL FILLING OPERATIONS.—Rescinded.

[A. G. 062.11 (9-22-41).] (C 1, Oct. 29, 1941.)

■ 64. EQUIPMENT.—Chemical maintenance troops are armed similarly to and for the same limited purposes as chemical depot troops. The organizational equipment includes a portable gas mask repair plant, light machine shop equipment, machine tools and spare parts for rehabilitation of chemical weapons, and certain decontamination materials and equipment. Such motor vehicles as are required constantly by the company are provided as organic equipment. For movement of the entire unit by motor or for transporting large quantities of salvage material, additional trucks must be supplied.

[A. G. 062.11 (9-22-41).] (C 1, Oct. 29, 1941.)

■ 65. TRAINING.—The military training \* \* \* for any of the various maintenance activities. However, certain specialists must be developed. These include sewing machine operators for repair of gas masks, mechanics for repair of chemical weapons and collective protection machinery, and supervisors

## CHEMICAL WARFARE SERVICE

for chemical salvage operations. In addition to their normal maintenance functions, the company may be called on to assist the depot company in certain filling operations and personnel should be trained for this purpose. The detailed program for training of a chemical maintenance company is set forth in mobilization training programs.

[A. G. 062.11 (9-22-41).] (C 1, Oct. 29, 1941.)

■ 79. TYPICAL MISSIONS.—*a.* The need for immediate action in case of contamination of combat equipment in use, the vital necessity for continuous functioning of supply installations although subjected to chemical attack, and the limited number of special decontamination troops generally will preclude their employment in forward areas during combat.

\* \* \* \* \*

[A. G. 062.11 (9-22-41).] (C 1, Oct. 29, 1941.)

## CHAPTER 5½

### IMPREGNATION OF CLOTHING

	Paragraph
Section I. General .....	79½-79½
II. Chemical impregnating company.....	79½-79½

### SECTION I

#### GENERAL

■ 79½. PROTECTIVE CLOTHING.—*a. Types.*—The two general types of protective clothing for issue to troops are the impermeable and permeable.

(1) *Impermeable.*—The impermeable protective clothing consists of an outer garment made of oil-treated fabric and underwear that has been chemically treated to neutralize mustard vapors. Either rubber overboots or specially treated service shoes are used with this outfit.

(2) *Permeable.*—The permeable clothing consists essentially of specially designed outer garments or modified serv-

## FIELD MANUAL

ice uniforms. Impregnated underwear is also used with this type of clothing but service shoes, which are treated by the individual, are the only footwear supplied.

b. *Gloves.*—Chemically treated cotton gloves are worn with both types of protective clothing but with the impermeable outfits either rubber gloves or oil-treated fabric gloves are also supplied.

■ 79 $\frac{1}{4}$ . DEFINITIONS.—a. Impermeable clothing is made of airtight, liquidproof and vaporproof oilskin material which, when worn with the gas mask, offers complete protection against vesicant liquid and vapor.

b. The term "impregnation" applies to the chemical or physical processes involved in rendering clothing resistant to the vapors of vesicant type chemical agents.

■ 79 $\frac{3}{4}$ . PURPOSE AND RESPONSIBILITY.—a. *Purpose.*—Clothing and fabric equipment is impregnated to minimize the danger of the wearer becoming a casualty through contact with the vapors of vesicants.

b. *Responsibility.*—(1) The Chemical Warfare Service is charged with the responsibility of impregnating such uniforms of the Army as may be deemed necessary. In a war where the use of chemicals by the enemy is extensive it may be necessary to provide all troops and civilians within the theater of operations with protective clothing. If the enemy is not equipped for long range projection of chemicals it may only be necessary to provide troops within the combat zone and personnel at certain chemical manufacturing plants in the zone of the interior with this type of clothing.

(2) The Quartermaster Corps is charged with procurement, storage, and issue of both types of protective clothing.

(3) (a) In the zone of the interior the impregnation of clothing is performed at impregnating plants operated by the Chemical Warfare Service and employing civilian labor.

(b) In the theater of operations initial impregnation or reimpregnation of clothing is performed at field impregnating plants.

■ 79 $\frac{1}{2}$ . DECONTAMINATION AND IMPREGNATION OF CLOTHING AND FABRIC EQUIPMENT.—a. *Decontamination.*—Clothing which

## CHEMICAL WARFARE SERVICE

has become contaminated will be changed as soon as possible. This may be done at aid stations or personnel decontamination stations. Contaminated clothing and web equipment will be taken to the impregnating unit in the rear area by the salvage platoon of the chemical maintenance company. In the reprocessing of clothing there are usually two steps necessary. First, it must be degassed. This will be done by essentially the same process as laundering and with standard laundry equipment.

*b. Impregnation.*—After clothing has been decontaminated it will be necessary to reimpregnate it before reissue to troops. After clothing has been reimpregnated it will be turned over to the Quartermaster Corps for reissue.

## SECTION II

### CHEMICAL IMPREGNATING COMPANY

■ 79 $\frac{1}{2}$ . ASSIGNMENT AND ORGANIZATION.—*a. Assignment.*—Chemical impregnating companies are assigned to the field army on the basis of one company to each 40,000 troops. They operate under the supervision of the army chemical officer.

*b. Organization.*—The chemical impregnating company is organized along military lines for administration, discipline, and its own defense. It is composed of a headquarters section for the military administration, mess, and supply of the organization, and three platoons for the operation of the plant on a three-shift, 24-hour basis. Each platoon consists of two sections, one operating the decontamination equipment and the other the impregnating equipment. The company is motorized but has not sufficient transportation to move its personnel and equipment without assistance of quartermaster truck companies.

79 $\frac{3}{4}$ . TRAINING AND EQUIPMENT.—*a. Training.*—(1) *Basic.*—The basic military training of the chemical impregnating company is the same as that given the chemical depot company. It includes a limited amount of training of selected personnel in the use of the caliber .50 machine gun for defense against aircraft. All members of the company should

## FIELD MANUAL

have a sound practical knowledge of chemical agents, particularly of the vesicant type, their action on materials and equipment, decontamination and first-aid processes, and the safety rules for handling dangerous chemicals. However, the purely military training of the company should not be extended to the detriment of its technical training.

(2) *Decontamination*.—The decontamination of clothing and fabric equipment is a simple procedure and is essentially the same as laundering with a slight change in temperature of the washing water and the addition of certain chemicals for the neutralization of the chemical agent with which the clothing is contaminated. Personnel assigned to the task of operating decontamination machinery must be trained in the use, care, and repair of the machinery supplied.

(3) *Impregnation*.—Personnel assigned to the impregnating sections must have a thorough knowledge of their equipment, its use, care, and maintenance.

b. *Equipment*.—The technical equipment and supplies of an impregnating company consist principally of a modified field laundry unit and decontaminating chemicals for use therein, plus a mobile impregnating plant and impregnating chemicals. The company is equipped with pistols and caliber .50 machine guns for antiaircraft defense. It is also provided with motor transportation for administrative purposes.

■ 79%. LOCATION.—The chemical impregnating company should be established for operations in the army service area near the quartermaster laundry battalion.

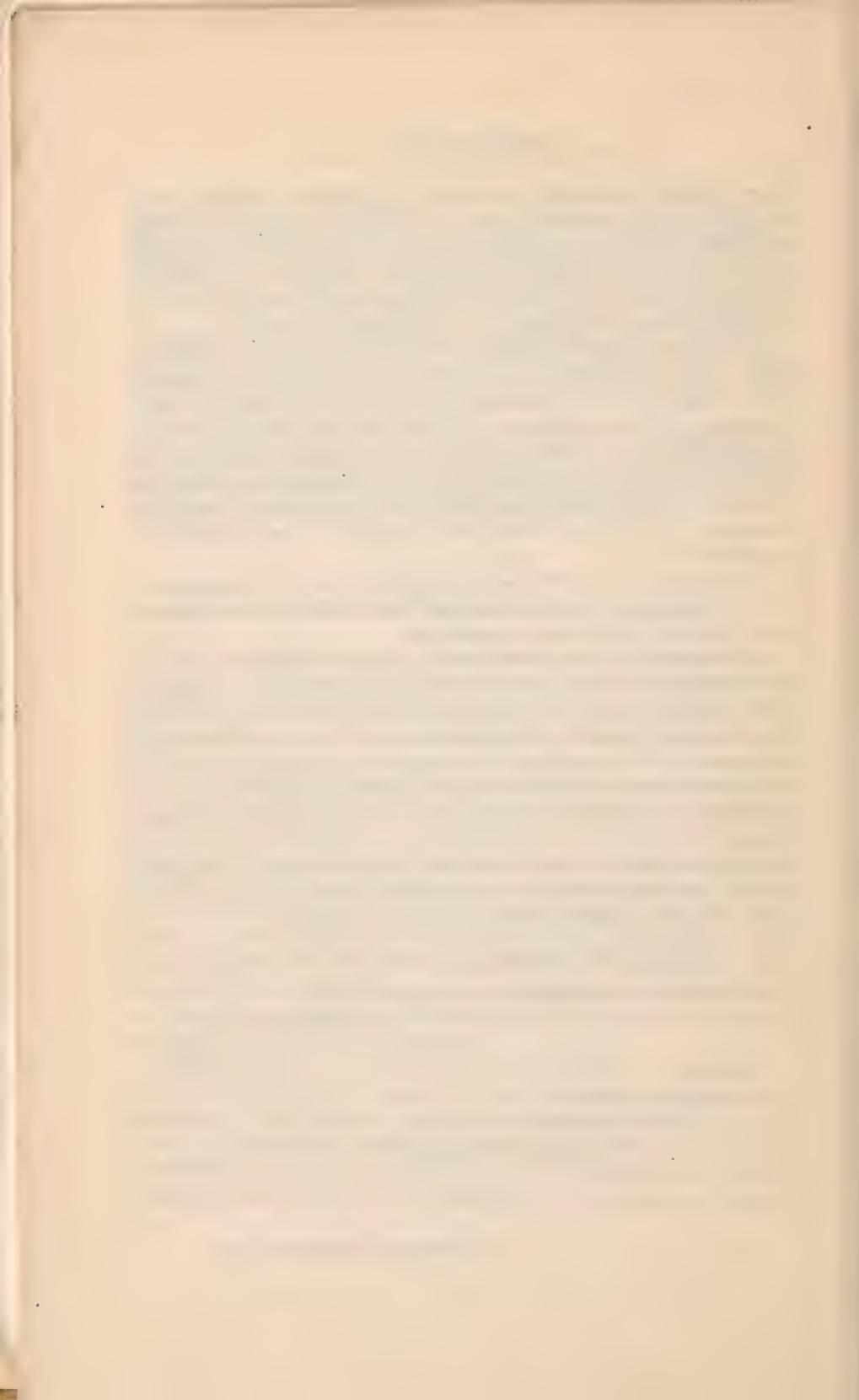
[A. G. 062.11 (9-22-41).] (C 1, Oct. 29, 1941.)

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,  
*Chief of Staff.*

OFFICIAL:

E. S. ADAMS,  
*Major General,*  
*The Adjutant General.*



# CHEMICAL WARFARE SERVICE FIELD MANUAL

## SUPPLY AND FIELD SERVICE

CHANGES }  
No. 2 }

WAR DEPARTMENT,  
WASHINGTON, May 6, 1943.

FM 3-15, February 17, 1941 is changed as follows:

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Air Forces	96-100	57
*	*	*
[A. G. 062.11 (7-1-42).]	(C 2, May 6, 1943.)	

■ 19½. (Added.) SERVICE CENTER.—A service center is a mobile establishment in the theater of operations designed to fill the maintenance, supply, salvage, construction, and transportation needs of at least two air force combat groups of any type of aircraft. Air force personnel charged with operating a service center comprise a service group consisting of a headquarters, a headquarters squadron, and one or two service squadrons.

[A. G. 062.11 (7-1-42).] (C 2, May 6, 1943.)

■ 21. (Superseded.) POINTS.—*a. Distributing point.*—A distributing point is a place other than a depot or railhead at which supplies are issued to regiments, Army Air Forces groups, or smaller units.

*b. Salvage point.*—A salvage collecting point is a locality on the battlefield where captured, abandoned, lost, or partially worn-out equipment or material is brought for further disposition.

*c. Service point.*—A chemical service point is an organized locality where bulk chemicals are stored for use at a nearby airdrome.

[A. G. 062.11 (7-1-42).] (C 2, May 6, 1943.)

## CHEMICAL WARFARE SERVICE

### ■ 35. FUNCTIONS.

\* \* \* \* \*

f. Supply of chemical agents in bulk as may be authorized for air force use, the filling of such containers as provided for the employment of these chemicals from aircraft, and the delivery of the filled containers at airplane loading points at airdromes.

\* \* \* \* \*

### ■ 36. ORGANIZATION.—*a. Officers.*—As in the case of other supply arms and services, the organization of the Chemical Warfare Service in the theater of operations is generally decentralized. (See distribution charts on page 3.) The theater of \* \* \* as a whole. One or more Chemical Warfare Service officers, of suitable grades, are assigned to each headquarters, communications zone; headquarters, advance, intermediate, or base section of the communications zones; regulating station, each army, corps, and division headquarters (stabilized situation); headquarters of each air force, command, and wing, for the headquarters of each air depot and service group.

*b. Chemical service troops.*—Supply and service units of the Chemical Warfare Service now provided for are—

(1) For the Army Ground Forces:

- (a) Chemical decontamination company.
- (b) Chemical depot company.
- (c) Chemical maintenance company.
- (d) Chemical composite company.

(2) For the Army Air Forces, see chapter 7.

(3) For the Army Service Forces:

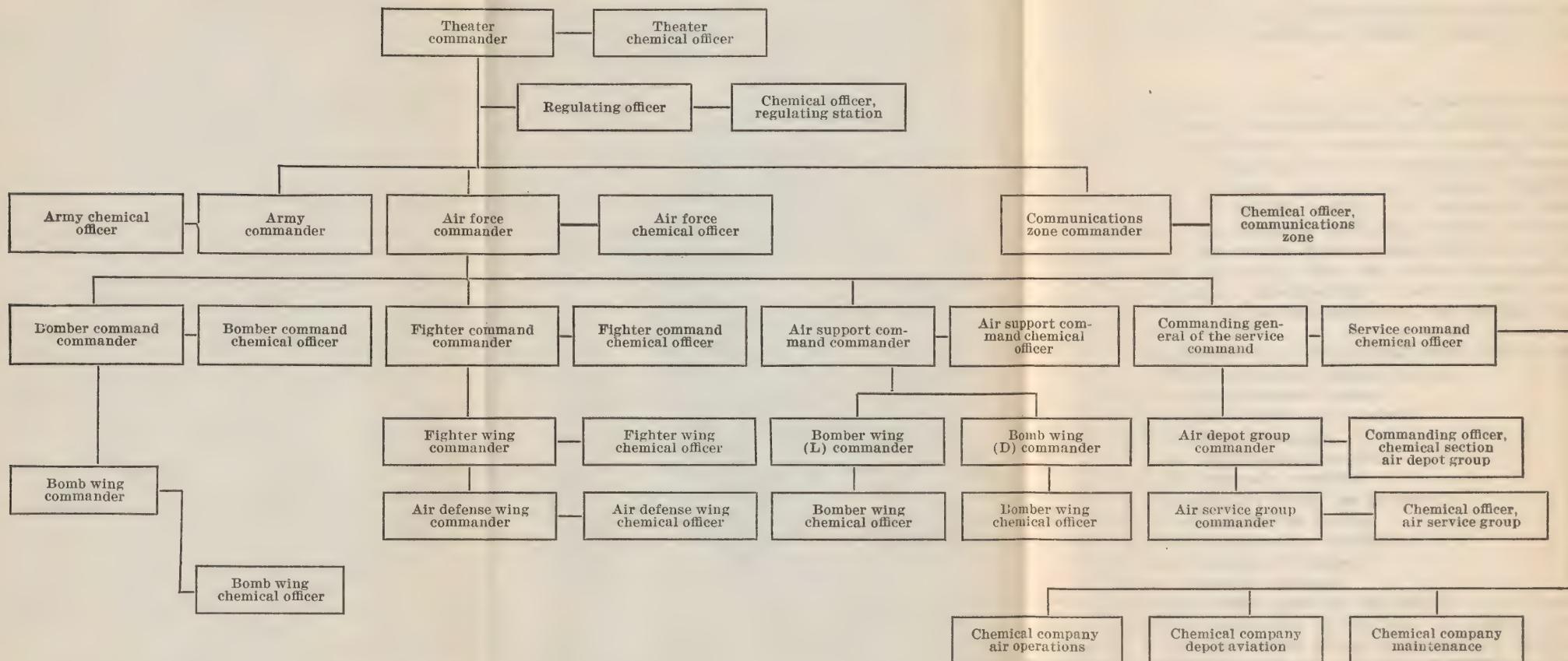
- (a) Chemical impregnating company.
- (b) Chemical laboratory company.
- (c) Smoke generator company.

(4) Chemical service units for the Army Ground Forces are assigned to each army as required. In addition, such numbers of chemical service troops as required are assigned to the communications zone and to the Army Air Forces. The organization and duties of the various classes of chemical service troops are discussed in chapter 3 to 7.

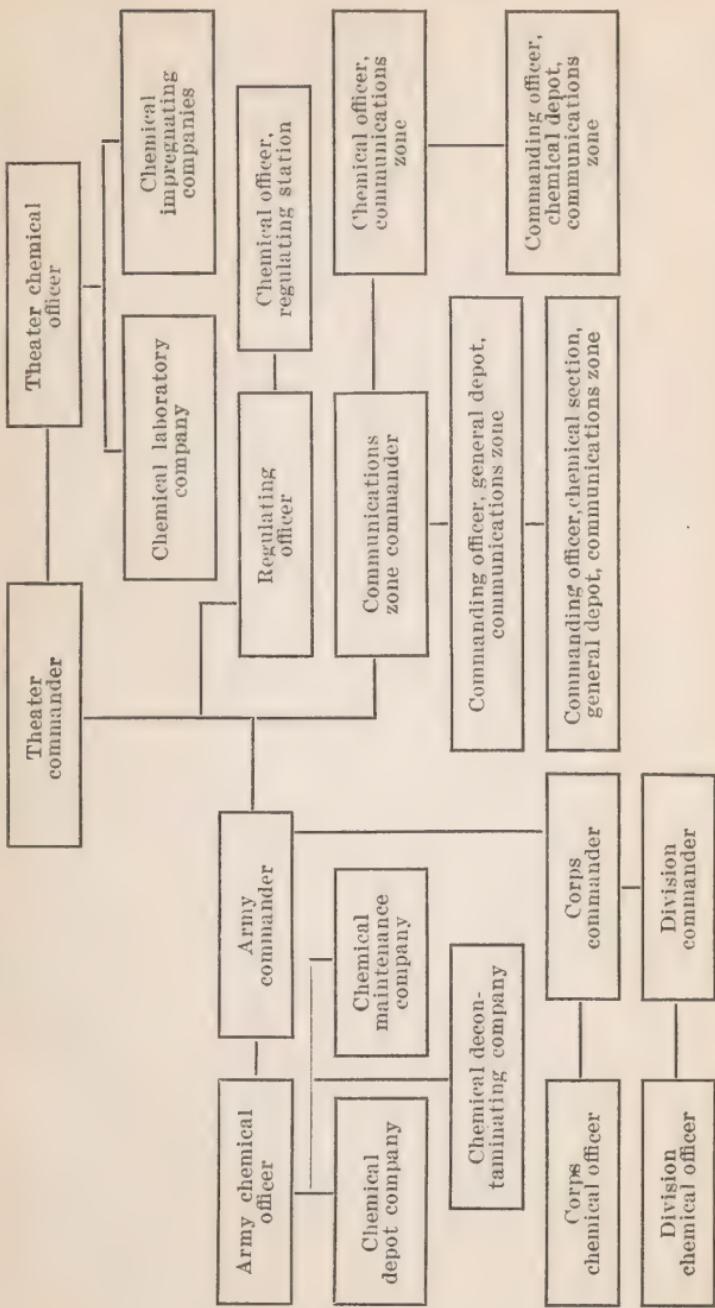
[A. G. 062.11 (7-1-42).] (C 2, May 6, 1943.)

qualitative  
quantitative  
method

DISTRIBUTION OF SERVICE AGENCIES. CHEMICAL WARFARE SERVICE,  
THEATER OF OPERATIONS, ARMY AIR FORCES



DISTRIBUTION OF SERVICE AGENCIES, CHEMICAL WARFARE SERVICE THEATER OF OPERATIONS



CHEMICAL WARFARE SERVICE

■ 39. CHEMICAL OFFICER, COMMUNICATIONS ZONE.—*a.*

\* \* \* \* \*

(9) Supply of chemical warfare equipment and materials to air force units operating from and quartered in the communications zone, and to such other troops as may be temporarily quartered there.

\* \* \* \* \*

[A. G. 062.11 (7-1-42).] (C 2, May 6, 1943.)

■ 41. (Superseded.) CHEMICAL OFFICERS, ARMY AIR FORCES.—One or more commissioned officers of the Chemical Warfare Service are assigned to the staffs of Army Air Forces commanders in the theater of operations. The assignment and principal duties of such officers in a typical air force are—

*a. Chemical officer, air force.*—The chemical officer of the air force is the advisor to the air force commander and his staff on all matters pertaining to chemical warfare. In addition to this general duty his responsibilities include—

(1) The general supervision of training of air force personnel in defense against chemical attack.

(2) Preparation of plans for chemical defense of the air force in accordance with the general tactical plan.

(3) Preparation of the chemical phase of offensive plans when the use of chemicals is contemplated.

(4) Preparation of general plans for the supply of chemical protective equipment to the air force and for the provision of such chemical munitions as are authorized for use by the air force. Such plans will include levels of stocks to be maintained at air force general depots and service centers.

(5) General supervision of the supply of defensive and offensive chemical equipment to the air force.

(6) Technical inspection of chemical warfare equipment of the air force.

(7) Maintenance of close liaison with plans and operations and with the chemical officers of the air force commands.

(8) Collection of chemical information concerning friendly and enemy forces. In this connection the air force chemical officer should be informed promptly of enemy chemical attacks, the location and extent of areas affected, the resulting casualties, and the type of chemical agent used in each instance.

## SUPPLY AND FIELD SERVICE

Samples of earth or other matter contaminated by new or unknown chemical agents should be forwarded promptly to the air force chemical officer for transmission to the nearest chemical laboratory for analysis.

(9) Recommendations to proper authority covering initial assignment and reassignment of chemical officers to the several staff sections of the air force commands.

(10) The air force chemical officer exercises technical control of and supervision over chemical warfare matters through chemical officers of the bomber, fighter, air support, and air service commands.

b. *Chemical officer, command and wing* (bomber, fighter, and air support).—(1) The chemical officers of the bomber, fighter, and air support commands and wings have in general the same duties and responsibilities with regard to the command or wing as the air force chemical officer has with regard to the air force. The duties of these officers are, of necessity, more detailed and their supervision of training and supply more personal. Where the air force chemical officer is responsible for the general supervision of chemical warfare training, the command and wing chemical officers are responsible for the actual training.

(2) The chemical officer of the command exercises technical control through the wing chemical officer. The wing chemical officer exercises technical control through the unit gas officer of the squadron. It should be noted that the wing may or may not be included in the organization of an air force.

c. *Chemical officer, air service command*.—The chemical officer of the air service command is the advisor to the commander and staff of the air service command on all matters pertaining to chemical warfare. In addition to this general duty he is charged with—

(1) The execution of general plans for chemical supply of the air force through the establishment of the necessary chemical warfare supply agencies.

(2) Supervision of the operation of such chemical service units as may be assigned or attached to the air force.

(3) Supervision of the training of such chemical service units as may be assigned or attached to the air force.

## CHEMICAL WARFARE SERVICE

(4) Command, so far as related to operations, of all chemical warfare personnel on duty with the air service command and not assigned or attached to subordinate units thereof.

(5) Technical inspection of the chemical warfare equipment of the air service command.

(6) Operation of Chemical Warfare Service maintenance, repair, and salvage facilities for Chemical Warfare Service equipment and material of the air force.

(7) Maintenance of close liaison with the chemical officer of the air force and the chemical staff officers of the depot and service groups of the air service command.

(8) Recommendation to proper authority covering assignment and reassignment of officers of the chemical service units assigned to the air service command and of chemical staff officers of the air depot and service groups.

(9) Technical control of chemical warfare matters through chemical staff officers of the air depot and service groups and the commanding officers of chemical service units.

*d. Chemical officer, air depot group.*—The chemical officer of the air depot group is the advisor to the commanding officer of the air depot group and his staff on all matters pertaining to chemical warfare. In addition to this general duty he is responsible for—

(1) The training in chemical warfare of the personnel of the air depot group and attached service organizations.

(2) The establishment and operation of the chemical section of the air force depot operated by the air depot group. This section stores and issues class II and IV chemical supplies.

(3) Technical control of chemical warfare matters within the air depot group through unit gas officers of organizations comprising the group.

*e. Chemical officer, service group.*—Chemical officer of the service group is the advisor of the commanding officer of the service group and his staff on all matters pertaining to chemical warfare. In addition to this general duty he is responsible for—

(1) The chemical warfare training of the personnel of the service group and attached service organizations.

(2) Supervision of the flow of supply of chemical protective equipment to the personnel of the service group and to tactical organizations supplied by the service center operated by the

## SUPPLY AND FIELD SERVICE

service group. Chemical supplies of class II and IV are stored and issued by the technical supply section of the service squadron.

(3) Supervision of the supply of chemical munitions to combat organizations supplied by the service center. Incendiary munitions are received in the service center area and stored by the ordnance company aviation (service center).

(4) Rendering such technical assistance as may be required from time to time by the personnel of the ordnance company aviation (service center) in connection with the handling of incendiaries and other chemical munitions that may be stored in the ammunition area of the service center.

(5) Recommendations concerning the disposition and employment of such chemical service units as may be attached to the service group for duty at the service center.

(6) Conduct of such schools of instruction for unit gas officers and noncommissioned gas officers as may be necessary to qualify antigas personnel for organizations supplied by the service centers in the event trained personnel are not available to such organizations from other sources.

(7) Technical control of chemical warfare matters within the service group through the unit gas officers of the organizations comprising the service group.

[A.G. 062.11 (7-1-42).] (C 2, May 6, 1943.)

■ 45. UNIT GAS OFFICERS.—*a. Army Ground Forces.*—Gas officers of

\* \* \* division chemical officer.

*b. Army Air Forces.*—See paragraph 41.

[A.G. 062.11 (7-1-42).] (C 2, May 6, 1943.)

■ 57. SCOPE AND RESPONSIBILITY.—*a.*

\* \* \* \* \*

(2) (As changed by C 1.) Repair and rehabilitation of weapons used by chemical combat troops and the air force.

\* \* \* \* \*

[A.G. 062.11 (7-1-42).] (C 2, May 6, 1943.)

■ 60. (Superseded.) RECOVERY.—*a.* Recovery in the theater of operations is taken to mean those procedures whereby United Nations chemical warfare matériel which has been damaged or

## CHEMICAL WARFARE SERVICE

abandoned, or enemy matériel which has been found or captured is rendered serviceable to our troops.

b. Primarily the salvage, repair, and transportation activities of the recovery process are the responsibility of chemical maintenance units, working with other chemical service units and quartermaster salvage troops.

c. Two recovery processes are prescribed with the understanding that short cuts will be used wherever possible. These procedures are called the "maintenance channel" and the "salvage channel."

d. The term "maintenance channel" is given to the procedure when the troops using, finding, or capturing the matériel are able to report its location either at the time it becomes un-serviceable or is abandoned in the case of friendly matériel, or shortly subsequent to its seizure in the case of enemy matériel. The report is made to a succeeding echelon of chemical maintenance who must evacuate the matériel, if necessary, repair, salvage or convert it, and forward it to a chemical depot for reissue. The maintenance unit will not only seek to convert enemy matériel to forms useful to our troops, but will forward specimens to a chemical laboratory company for analysis and report. When the repair, salvage, or conversion of matériel calls for facilities of other chemical service units, the maintenance company will transport the items to the appropriate unit, and from there, except in the case of contaminated clothing, to a chemical warfare depot. Whenever a maintenance unit finds it impossible to process matériel called to its attention, it will evacuate or report the matériel to the next succeeding echelon of maintenance.

e. The term "salvage channel" is given to the procedure when the matériel is abandoned, damaged, found, or captured under circumstances which prevent its being reported by the using or seizing troops. Under these circumstances, a systematic search of the areas involved is made by quartermaster salvage personnel. The quartermaster troops evacuate the matériel to collecting points where specialists of the various maintaining services assist in its segregation and disposition. In the case of chemical warfare matériel, the specialists are trained chemical warfare personnel permanently attached to the quartermaster salvage unit. These specialists will effect the removal

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**e.** all undamaged chemical warfare items to a chemical depot, at the same time forwarding specimens of undamaged enemy matériel to the controlling chemical officer. All damaged matériel, enemy or otherwise, will be reported to the nearest chemical maintenance unit. The maintenance unit will evacuate and process the matériel exactly as prescribed for the maintenance channel above.

*f.* Two exceptions to the regular recovering procedures described above are—

(1) Contaminated clothing brought to a collecting point is delivered to the Quartermaster Corps for decontamination prior to its impregnation or reimpregnation, if required, by the chemical impregnating company and subsequent return to the Quartermaster Corps for storage and reissue.

(2) All Chemical Warfare Service matériel (other than clothing) which is to be subjected to the recovery process and which has been contaminated by chemical agents is decontaminated where found by the recovering troops. Where this is impracticable, the assistance of special decontaminating units is requested. Once the matériel has been decontaminated, it is processed in the same manner as any other item.

*g.* The chemical maintenance company is not provided with sufficient organic transportation for all the contingencies incident to the recovery process. Where more is needed, it may be requested from the nearest quartermaster motor pool.

*h.* The maintenance company is responsible for such destruction of recovered matériel as may be necessitated during the time the matériel is being processed. Enemy ammunition which cannot be converted to friendly use and which is burdensome to transport will be destroyed. Such destruction calls for rigid safety precautions both to protect destroying personnel and to avoid contamination of areas to be traversed by other friendly troops.

[A. G. 062.11 (7-1-42).] (C 2, May 6, 1943.)

**■ 79½.** (Superseded.) PROTECTIVE CLOTHING.—The three types of protective clothing for issue to troops are termed "special," "protective," and "impermeable."

*a. Special.*—Articles of wear so modified in design as to assist in gas protection, *unimpregnated*. These include woolen and

CHEMICAL WARFARE SERVICE

cotton shirts, trousers, and breeches, and herringbone twill jackets, trousers, and one-piece suits.

b. *Protective*.—Articles of wear of special design *impregnated* and chemically maintained, including covers, protective, individual (impermeable). These comprise woolen and cotton shirts, trousers, and breeches; herringbone twill jackets, trousers, and one-piece suits; cotton drawers and undershirts, and woolen socks; and canvas leggings, woolen hoods, and cotton gloves.

c. *Impermeable*.—Articles of wear made from materials normally resistant or impervious to chemical agents—hence, not requiring impregnation to make them protective.

■ 79 $\frac{1}{4}$ . DEFINITIONS. (Rescinded.)

[A. G. 062.11 (7-1-42).] (C 2, May 6, 1943.)

■ 79 $\frac{1}{2}$ . (As added by C 1.) DECONTAMINATION AND IMPREGNATION OF CLOTHING AND FABRIC EQUIPMENT.—a. *Decontamination*.—Clothing which has \* \* \* personnel decontamination stations. Contaminated clothing and web equipment will be turned over to the Quartermaster Corps for decontamination.

\* \* \* \* \*

[A. G. 062.11 (7-1-42).] (C 2, May 6, 1943.)

■ 79 $\frac{3}{4}$ . ASSIGNMENT AND ORGANIZATION.—a. *Assignment*.—Chemical impregnating companies are assigned to the theater of operations. They operate under the supervision of the theater commander.

b. *Organization*.—The chemical impregnating \* \* \* its own defense. It is composed of a company headquarters for the military administration, mess, and supply of the organization, and two platoons of three sections each for the operation of two semifixed impregnating plants on a three-shift, 24-hour basis. The company is motorized but has not sufficient transportation to move its personnel and equipment and will require additional transportation from the communications zone for movement.

■ 79 $\frac{3}{4}$ . TRAINING AND EQUIPMENT.—a. *Training*.

\* \* \* \* \*

## SUPPLY AND FIELD SERVICE

(2) (Superseded.) *Decontamination.*—The Quartermaster Corps is charged with the decontamination of clothing and web equipment.

\* \* \* \* \*

b. *Equipment.*—The technical equipment and supplies of an impregnating company consist principally of a semifixed impregnating plant and impregnating chemicals. The company is equipped with M1903 rifles with antitank grenade launchers, antitank rocket launchers, carbines, and caliber .50 machine guns. It is also provided with motor transportation for administrative purposes.

[A. G. 062.11 (7-1-42).] (C 2, May 6, 1943.)

■ 88. FUNCTIONS.—The technical functions of the chemical laboratory company are as discussed in section I. The personnel of the company is provided with small arms for emergency protection, but, other than this, the company has no combat functions.

■ 89. ASSIGNMENT.—One chemical laboratory company is assigned to each theater of operations. It operates under the supervision of the theater chemical officer.

[A. G. 062.11 (7-1-42).] (C 2, May 6, 1943.)

■ 92. EQUIPMENT.

\* \* \* \* \*

c.

\* \* \* \* \*

The chemical laboratory company is not provided with sufficient organic transportation for its movement by motor. When movements of the chemical laboratory are to be made, transportation for the greater part of the supplies and personnel must be provided by other agencies. Arrangements for movements are made by the theater chemical officer.

■ 93. LOCATION.—a. (Superseded.) The chemical laboratory is normally located near general headquarters of the theatre. Regard must be given to concealment from enemy observation and to road accessibility so that the laboratory facilities are quickly available to the area served. Best location is a city or village

CHEMICAL WARFARE SERVICE

where the laboratory can use existing buildings, electricity,  
water, and heat.

\* \* \* \* \*

[A. G. 062.11 (7-1-42).] (C 2. May 6, 1943.)

## SUPPLY AND FIELD SERVICE

### CHAPTER 7

#### CHEMICAL SERVICES TO THE ARMY AIR FORCES

■ 96. GENERAL.—*a. Chemical services to the Army Air Forces.*—In general, the chemical services required by the Army Air Forces are the same as those for the ground forces. In addition, certain services peculiar to air operations are called for. The rendering of these services and the fact that air force units are frequently located at considerable distances from the ground forces make necessary separate chemical units organized to operate exclusively with Army Air Forces installations. These services are performed by—

(1) Chemical staff sections (covered in Tables of Organization), assigned to the headquarters, Army Air Forces; headquarters of numbered air forces, air force commands, air depot groups, service groups, wing, and in certain instances combat groups. The general duties of these staff sections as represented by the chemical officers heading each section are outlined in paragraph 41.

(2) Chemical service troops. Supply and service units of the Chemical Warfare Service now provided for the Army Air Forces are—

- (a) Chemical depot company, aviation.
- (b) Chemical company, air operation.
- (c) Chemical storage company, aviation.
- (d) Chemical maintenance company, aviation.

*b.* These units are assigned as required. The normal basis of assignment within a typical air force is—

Unit	Basis of assignment
Chemical depot company, aviation	1 per air force
Chemical company, air opera- tions	1 per bombardment group

## CHEMICAL WARFARE SERVICE

<i>Unit</i>	<i>Basis of assignment</i>
Chemical storage company, aviation	1 per air force (continental United States only)
Chemical maintenance company, aviation	1 per air force

Chemical maintenance companies, aviation, are assigned to air forces when corresponding maintenance facilities are not available from other sources.

■ 97. (Superseded.) **CHEMICAL DEPOT COMPANY, AVIATION (T/O 3-418).**—*a. Functions.*—The chemical depot company, aviation, is designed to set up and to operate a chemical ammunition depot (class V). This company functions under the service command of the air force and is responsible for the storage and issue for all types of chemical ammunition other than chemical filled bombs, which are ordnance items. Ammunition is normally moved via quartermaster transportation from the depot to refilling point sections of chemical companies, air operations, and to the ammunition areas of service centers located in forward areas.

*b. Organization.*—The chemical depot company, aviation, consists of an administrative section which contains the depot overhead, one chemical section designed to handle all toxic and nontoxic bulk chemicals, one incendiary section designed to handle all types of incendiary munitions and one security and maintenance section to provide for maintenance of handling equipment, first aid facilities for depot personnel, and security for the chemical storage areas.

■ 97½. (Added.) **CHEMICAL COMPANY, AIR OPERATIONS (T/O 3-457).**—*a. Functions.*—Chemical companies, air operations, are specialized organizations designed to provide the necessary service in connection with the delivery of filled chemical tanks to the combat squadrons of one bombardment group and with the removal from the airdrome, maintenance and refilling of such tanks as may be brought back by returning airplanes. These companies are normally held under the control of the air service commander and are not attached to service groups (except for training purposes) until chemical operations are about to be

## SUPPLY AND FIELD SERVICE

initiated, at which time one company, per bombardment group assigned chemical missions, is attached to the service center supplying that group.

b. *Organization*.—The chemical company, air operations, consists of a company headquarters containing the usual administrative overhead including a mess, one refilling point section designed to operate the company refilling point, from which bulk chemicals are delivered by quartermaster transportation to the chemical service point in the vicinity of the using air-drome, and four platoons, each of which is organized and equipped to set up and to operate a chemical service or distributing point in the vicinity of a combat squadron. The company has four officers, each of whom commands a platoon when all platoons are actively engaged in filling operations.

■ 97½. (Added.) **CHEMICAL STORAGE COMPANY, AVIATION (T/O 3-417)**.—This company is a specialized organization designed to provide the necessary personnel for technical housekeeping in connection with storage and security of toxic and incendiary ammunition. It consists of a company headquarters and an indeterminate number of sections consisting of a warrant officer and from four to seven enlisted men each. Sections of this company are attached to the station complement of bases at which toxic and incendiary munitions are stored.

■ 97¾. (Added.) **CHEMICAL MAINTENANCE COMPANY, AVIATION (T/O 3-47)**.—The chemical maintenance company, aviation, is organized under the same Table of Organization as is the chemical maintenance company and performs services for the air force corresponding to those performed for ground forces by the chemical maintenance company. This organization is normally employed as part of an air force in a theater of operations only when the required maintenance functions are not provided by ground forces or ASF installations.

■ 98. (Superseded.) **SUPPLY**.—Chemical warfare supplies required by air force units in the theater of operations are normally obtained from zone of the interior or communication zone installations in accordance with the following:

a. *Chemical supplies, class II and IV*.—Supplies of this nature flow from zone of the interior or communication zone installa-

## CHEMICAL WARFARE SERVICE

tions to air force general depot. Supplies received by this depot are transmitted by air, rail, or road to air force service centers where they are received, stored, and issued by the technical supply section of the service squadron. The handling of chemical warfare supplies by the technical supply section of the service squadron is under the supervision of the chemical officer of the service group.

*b. Chemical supplies, class V.*—This class of supplies is received by the air forces, chemical ammunition depot established and operated by the chemical depot company, aviation, within the air force service area. Supplies are shipped from this depot to chemical refilling points established by chemical companies, air operations and to the ammunition areas of service centers via quartermaster transportation. In those instances where an air force chemical ammunition depot has not been established, incendiary munitions are shipped from zone of interior or communication zone chemical depots to the air force, ordnance ammunition depot from which shipment to ammunition areas of service centers is accomplished in the same manner as if the shipment had been made from an air force chemical ammunition depot. Class V supplies are moved from ammunition areas of service centers to combat squadron airdromes and from chemical refilling points to chemical distribution points in the vicinity of combat airdromes by quartermaster transportation.

■ 99. MAINTENANCE.—Maintenance of chemical warfare equipment will be in accordance with the functions of the chemical maintenance company as described in paragraph 62.

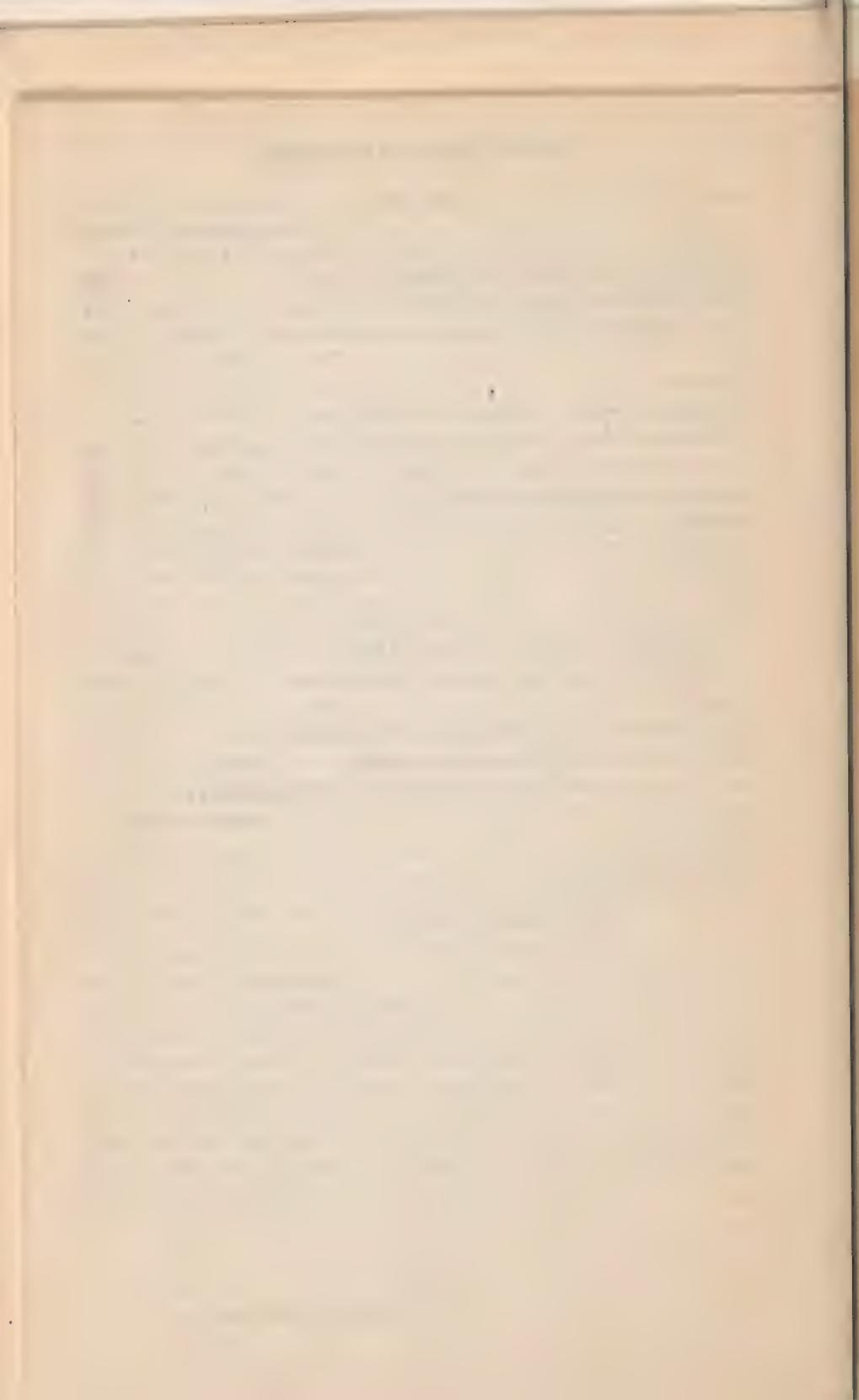
■ 100. DECONTAMINATION.—Air force units are trained in methods of decontamination and are provided with sufficient quantities of appropriate equipment to enable them to perform such decontamination operations as are rendered necessary by combat conditions. Air force squadrons are provided with special power-driven decontamination apparatuses, M3A1, for the rapid decontamination of airdromes and matériel. Chemical Warfare Service personnel are provided as an integral part of tactical air force squadrons and squadron commanders will make the maximum use of their services.

[A. G. 062.11 (7-1-42).] (C 2, May 6, 1943.)

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[A. G. 062.11 (7-1-42).] (C 2, May 6, 1943.)		
<b>BY ORDER OF THE SECRETARY OF WAR:</b>		
G. C. MARSHALL, <i>Chief of Staff.</i>		
<b>OFFICIAL:</b>		
J. A. ULIQ, <i>Major General,</i> <i>The Adjutant General.</i>		



**FM 3-15**  
**C 3**

## **CHEMICAL WARFARE SERVICE FIELD MANUAL**

### **SUPPLY AND FIELD SERVICE**

#### **CHANGES }**

No. 3 }

**WAR DEPARTMENT,  
WASHINGTON 25, D. C., 14 October 1943.**

FM 3-15, 17 February 1941, is changed as follows:

Symbols for certain war gases as referred to in this manual are changed as follows. These symbols will be corrected wherever they occur in the manual.

	<i>Symbol</i>	
	<i>Old</i>	<i>New</i>
War gas		
Mustard gas	HS	H
Lewisite	M-1	L

[A. G. 300.7 (2 Oct 43).]

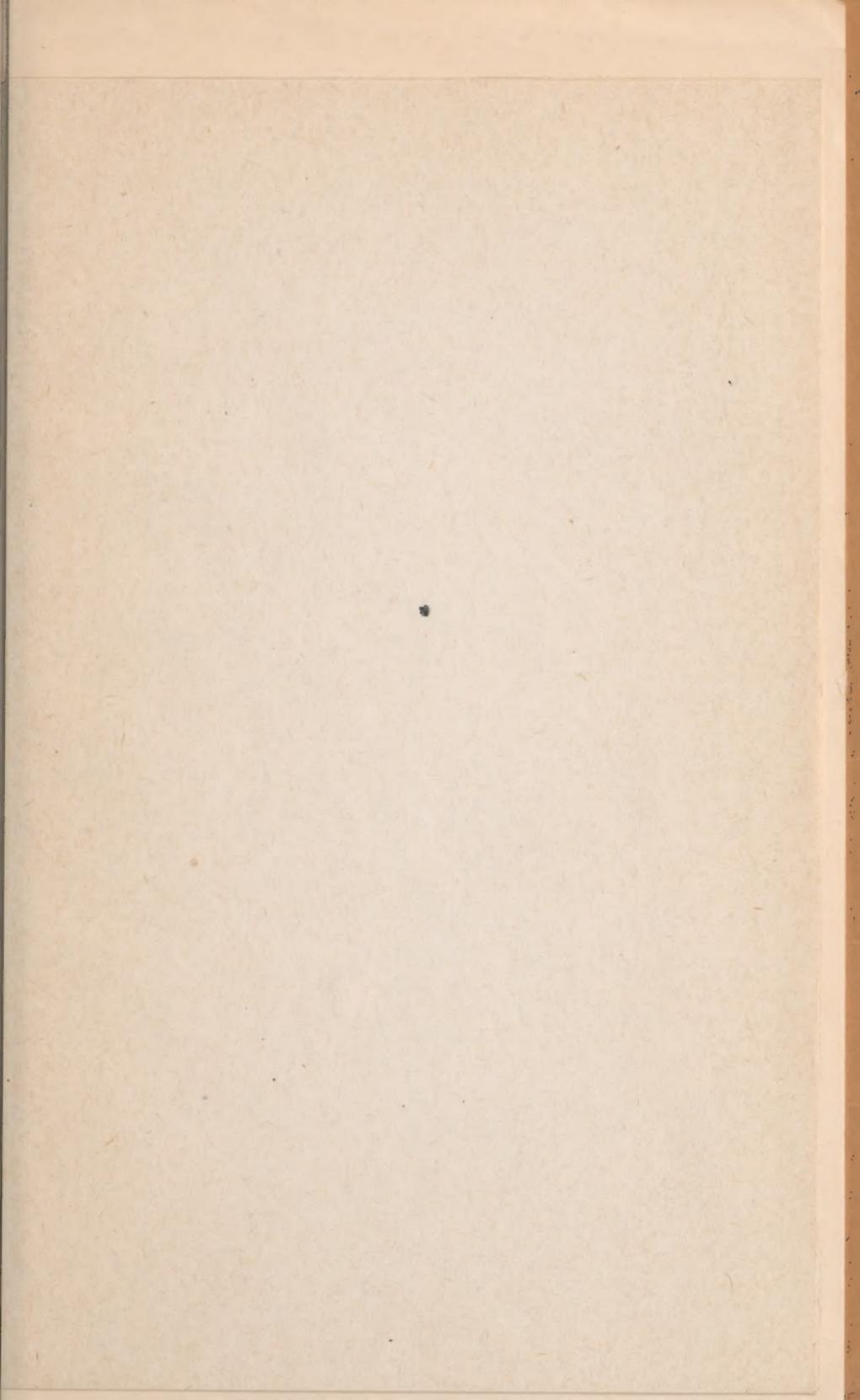
**BY ORDER OF THE SECRETARY OF WAR:**

**G. C. MARSHALL,**  
*Chief of Staff.*

**OFFICIAL:**

**J. A. ULIO,**  
*Major General,*  
*The Adjutant General.*





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